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SEMI-MONTHLY

VOL. XX. CHICAGO, JULY 1, 1916 No. 13

Power for Comfort and Convenience

ALL THE COMFORTS OF HOME AND MANY OTHERS AT CHICAGO'S NEW Y. M. C. A. HOTEL

PROVIDED FOR THE YOUNG MEN'S Christian Association of Chicago by leading business men of the city, the new hotel building has been completed at an approximate cost of $1,350,000, and was opened to the public on May 21. It is of modern fireproof construction, 19 stories in height, with 2 basements, and occupies a ground space 96 by 166 ft. Its entire exterior is constructed of gray brick and terra cotta, giving a uniformly pleasing appearance.

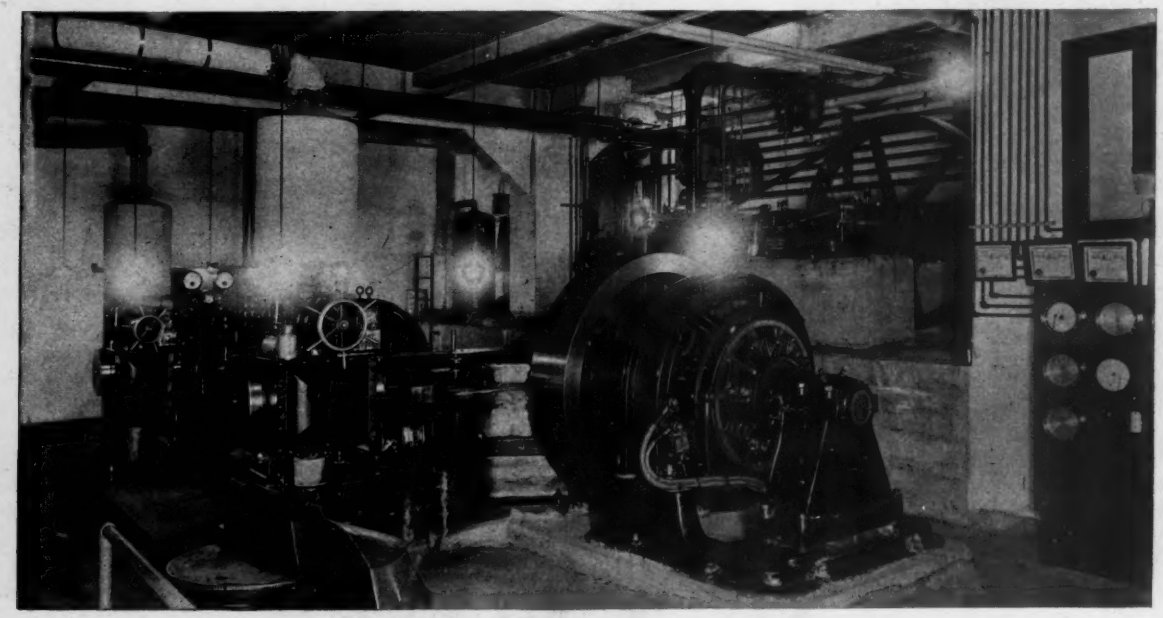


FIG. 1. VIEW SHOWING GENERATING UNITS AND REFRIGERATING MACHINE

Check rooms, barber shop, billiard room, and employment bureau are located in the basement. On the first floor are the booking office, dining rooms and lavatories. Spacious lobbies, correspondence and reading rooms occupy the second floor. Above this, on the next 16 floors, are 1821 small bedrooms, all outside locations, steam heated, electric lighted, and thoroughly ventilated.

Centrally located on each of the 16 floors is a large lavatory, where, in addition to the usual facilities, shower baths and clean towels are provided for the use of guests without extra charge. Bubbling type drinking fountains supplying cooled filtered water are also conveniently placed on each floor. On the top or 19th floor a laundry fully equipped with modern appliances is able to handle readily the hotel's linen, and its capacity will be increased as conditions demand.

This hotel is not intended as a permanent home, but rather as a temporary residence, where, without a Y. M. C. A. membership fee, men may be comfortably housed in a wholesome environment until they are in a position to locate permanently. The rates charged are from 30

to 50 cents per day.

In view of the comparatively small income due to low rates, it is, of course, the wish of the hotel administration to employ such operating methods as will ensure economy and guard against any deficit. Geographically, as well as otherwise, the power plan is a logical location for the adoption and rigid application of efficient methods.

To accomplish this many approved regulating, metering and recording appliances have been installed. Records are kept of the amounts of coal fired, water evaporated and power output for each watch. From this data and the price of coal, the cost of evaporation for 1000 lb. of water is then determined and

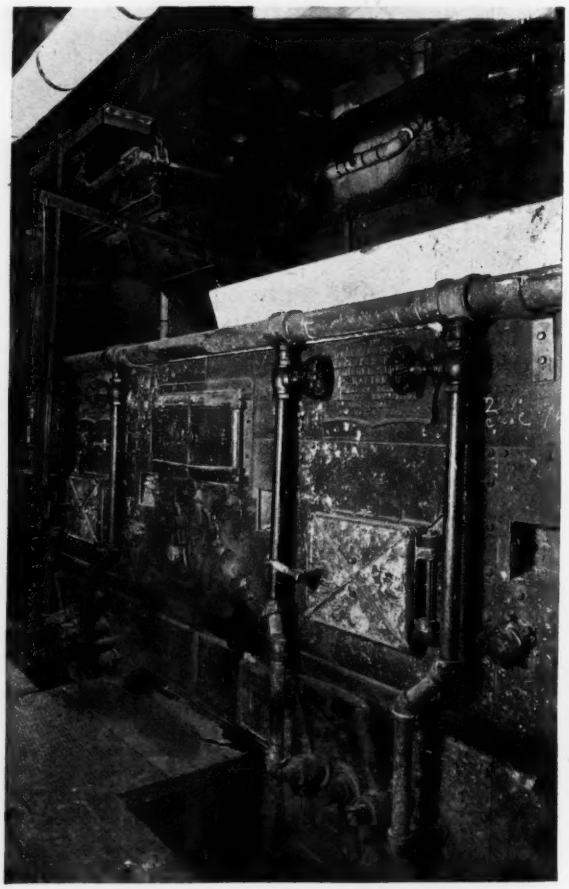
FIG. 2. EXTERIOR OF NEW Y. M. C. A. HOTEL

also placed on the record. Thus the boilers are at all times operated under test conditions, and by reference to the daily engine room report, as shown in Fig. 4, the cost of steam generation is available for comparison with a standard rate based upon efficient operation. Any decided variation tending to increase the evaporation cost can be investigated at once and steps taken to eliminate the faulty conditions before an appreciable loss is effected. A monthly statement of evaporation gives a tabulation of the daily records.

CHARACTER OF THE LOAD

HOTEL power plants are called upon to furnish a broad and reliable service. Light, power, heating, refrigeration and ventilation, in their various forms, constitute a 24-hr. load that is often subjected to severe demands.

At present the daily electrical output of this plant averages about 1600 kw.-hr. Approximately one-half of this is consumed by the 3000 lights, chiefly 60-watt units, and the balance is used for operating 3 35-hp. elevator motors and various fan motors, etc. The current is generated by a 3-wire d.c. machine at a voltage of 125, used for lighting, and 250 volts for motor service. In addition to the house lighting load current is supplied at low voltage to a large electric sign located on the roof.



F.G. 3. BOILER ROOM VIEW, SHOWING WEIGH HOPPER

Heating is accomplished with a vacuum return system using exhaust steam. Approximately 25,000 sq. ft. of direct heating surface is provided for the bedrooms, while the lobbies, dining halls, and other large rooms are heated by the indirect system of passing air over steam coils with an approximate surface area of 3000 sq. ft.

Live steam at 85 lb. pressure is supplied to the laundry which at present handles 6000 pieces daily and will have an ultimate capacity of 15,000 pieces. The kitchens also require live steam for cooking, warming, etc., and this is delivered at 50 lb. pressure.

STEAM GENERATION

LOCATED 32 ft. below the street level are 2 Geary water-tube boilers, each rated at 200 hp., which generate at 125 lb. pressure. They are equipped with Model

621.05 v.20 Jy-Dec

Y M C A HOTEL

DAILY ENGINE ROOM REPORT Date

	Amperes No. 1	Amperes No. 2	Balance +	Balance −	Volts	Machines	Started	Stopped	Started	Stopped	Hours	Brine Cold	Brine Warm	Report of Work Done
7 a.m.						Generator No. 1								
8						" No. 2								
9														
10						House Pump No. 1								
11						" " No. 2								
12 p.m.						Vac. " No. 1								
1						" " No. 2								
2						Boiler " No. 1								
3						" " No. 2								
4						Air " No. 1								
5						" " No. 2								
6						" " No. 3								
7						Boiler No. 1								
8						" No. 2								
9						Fire Pump								
10														
11						Ice Machine								
12 a.m.														
1														
2														
3														
4														
5														
6														

Coal Used		Water Evaporated		E. W. Generator			
1st Shift		1st Shift		1st Shift		Coal Rec'd	Evaporation
2nd Shift		2nd Shift		2nd Shift		Dealer	Cost 1000 lb. Water
3rd Shift		3rd Shift		3rd Shift		Price	
Total		Total		Total			

Engineer 1st Shift — Fireman 1st Shift
Engineer 2nd Shift — Fireman 2nd Shift
Engineer 3rd Shift — Fireman 3rd Shift

Y M C A HOTEL

STATEMENT OF EVAPORATION

Month of

Date	Coal Fired Boiler R. Wts.	Coal Recovered Yard Wts.	Kind of Coal	Price	Dealer	Pounds of Water Evaporated	Lbs. Water per Lb. Coal	Cost 1000 lbs. Water
1								
2								
3								
4								
5								
6								
7								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
Totals								

Average Evaporation—Boiler Room Weights

Average Evaporation—Yard Weights

Average Cost to Evaporate 1000 lbs. Water—Boiler Room Weights

Average Cost to Evaporate 1000 lbs. Water—Yard Weights

FIG. 4. DAILY ENGINE ROOM REPORT AND MONTHLY EVAPORATION STATEMENT

automatic smokeless furnaces of the dutch oven type and Model mechanical stokers. A Spencer regulator controls the action of the damper and the speed of the stoker engine. Draft over the fire and at stack is indicated and recorded by a Bloncк boiler efficiency meter placed in the engine room.

Feed water is taken from a receiver tank with an automatic makeup valve and heated to 210 deg. F. with exhaust steam in a Reilly multicoil heater. It is supplied to the boiler by 2 duplex pumps and passes through a Venturi meter.

Handling Coal and Ash

Fuel used at present is Illinois screenings. It is delivered to the plant in trucks and dumped direct into a 60-ton reinforced concrete hopper located at the rear of the building. Steel plates are placed on the bottom of the hopper to prevent pitting and provide a smooth surface.

Coal is fed to the stokers from a traveling weighing hopper located directly beneath the main hopper. All coal is weighed as fired and the weights recorded upon a boiler room record test.

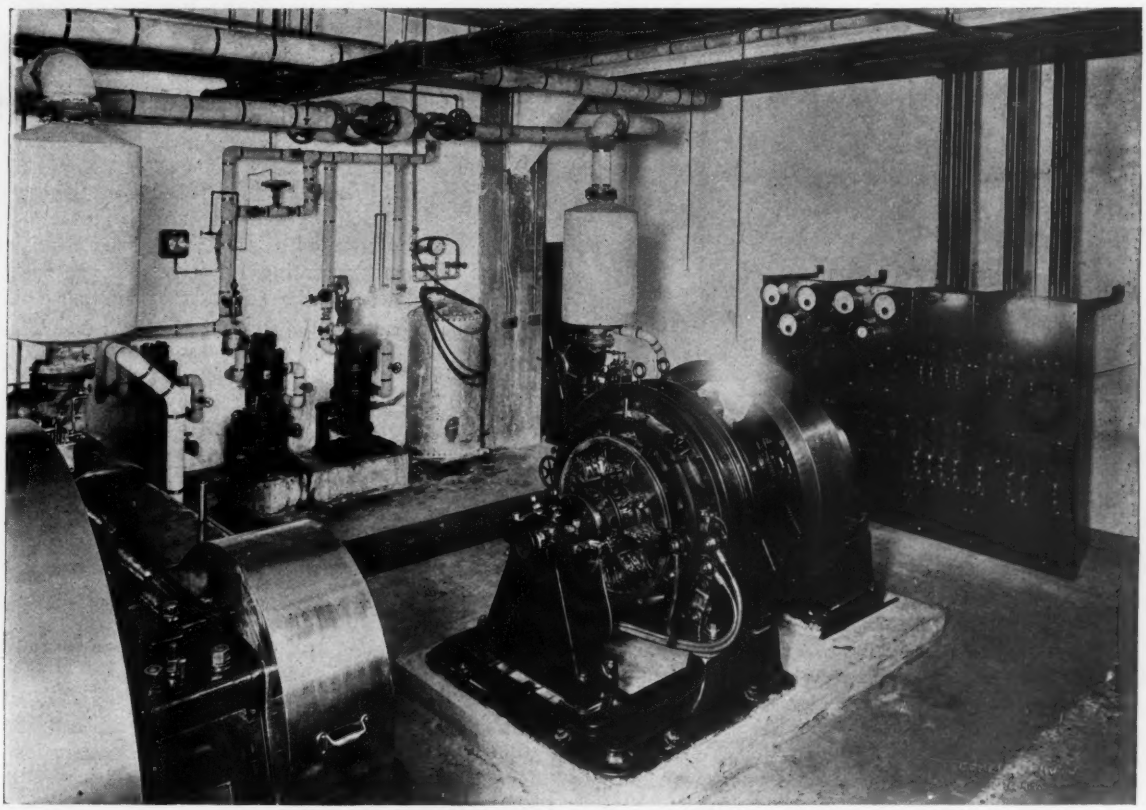


FIG. 5. AIR COMPRESSORS, 60-KW. UNIT, AND SWITCHBOARD

Ashes are removed from pits in front of the boilers by means of a Green steam ejector system and elevated to an outside tank from which they may be conveniently dumped into wagons for final disposal.

Engine Room Equipment

Two Ridgway dynamos, one rated at 100 kw. and the other at 60 kw., generate direct current for a 3-wire distributing system. Driving the 100-kw. generator is a direct-connected Ridgway engine, 15 by 16 in., running at a speed of 225 r.p.m. A similar engine, 11 by 14 in., operates the 60-kw. generator at the same speed. Both engines are equipped with Rites governors.

Current from the generating units is led through underground ducts to a 4-panel black slate switchboard located at one end of the engine room. Indicating and

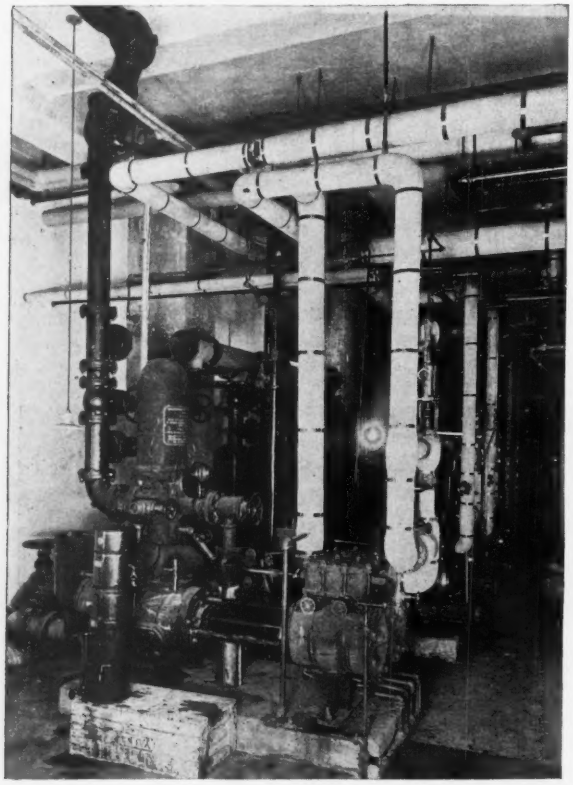


FIG. 6. PUMP ROOM WITH FIRE PUMP IN THE FOREGROUND

recording instruments and circuit breakers are placed on 2 of the panels and the balance of the board is devoted to distribution switches. Ammeters and voltmeters are of Westinghouse make, I T circuit breakers are used and a Sangamo integrating watthour meter is used to record the electrical output.

Near the engineer's desk and mounted on a marble slab are pressure gages, indicating the pressure of each boiler, the laundry, kitchen, and heating steam and back pressure. The Blonck boiler efficiency meter is mounted in the center and the Venturi meter stands at one side.

Compressed air is used for sewage disposal in connection with 2 Shone sewage ejectors, each having a 50-gal. capacity. This air is supplied by 2 steam-driven compressors of the locomotive type, 8 by 11 by 10 in., and a similar compressor, 11 by 9½ by 12 in., furnishes air for cleaning motors, etc. All 3 compressors are of Westinghouse Air Brake Co. make.

Refrigerating machinery is situated at one side of the engine room. Ice is made from raw-water, the capacity of the freezing tank being 9 50-lb. cans. The refrigerating fluid is carbonic anhydride, which is compressed by a 10-ton Kroeschell Bros. ice machine driven by a 20-hp. d.c. Crocker-Wheeler motor. A large refrigerator located in the basement for meats and vegetables and small refrigerators in the kitchens above are cooled by the direct expansion process.

After being filtered, drinking water is cooled by flowing through a tank fitted with a brine coil, and distributed by means of a loop system. Moulded cork covering is applied to all refrigerating lines.

Pumping Equipment

For the feed-water supply, 2 Worthington duplex pumps, 7¼ by 4½ by 10 in., are employed. Located beside these are 2 Blake-Knowles simplex vacuum pumps, 8 by 10 by 12 in., and next are 2 Worthington duplex pumps, 12 by 8½ by 10 in. for house service. A Blake-Knowles underwriters' fire pump, 14 by 7½ by 12 in., with a capacity of 500 gal. per minute, gives 2 good 1½-in. smooth nozzle streams. The house-service pumps may, if desired, be compounded with this pump, thus affording ample capacity for fire duty.

Steam is supplied to the pumps and engines through separate 5-in. lines, which connect to a 7-in. header. The expansion bends are horizontal and the lines are covered with an 85 per cent magnesia covering.

All air for ventilation is washed by forcing it through a sheet of water spray. Circulation is then accomplished with a number of motor driven fans ranging in size from 45 to 55 in., and situated in various sections of the building.

Provision has been made in the design of the engine room for an additional generating unit, and a 200-kw. machine is to be installed as soon as the load conditions warrant. Steam generating capacity will, at such a time, be increased by the addition of another boiler.

This plant is under the supervision of N. L. Wetherbee, chief engineer of Y. M. C. A. buildings in Chicago, and W. C. Metcalf is the engineer in charge.

U. S. Civil Service Commission announces an examination, July 18, for natural gas engineer to fill a vacancy in the Bureau of Mines, Department of the Interior, for service in the field, at a salary ranging from $1800 to $2500, and vacancies as they may occur, duties being to participate in the engineering and economic work of the Bureau of Mines in relation to production, transportation, distribution and utilization of natural gas throughout the United States, and with special reference to prevention of waste and improvement of methods. Graduation in engineering and not less than 2 yr. experience in the designing, constructing and operating of natural gas producing or transportation properties, are prerequisites for consideration. Applicants must have reached their twenty-first but not their fortieth birthday. Apply for Form 2118.

Blowoff Valves and Systems

PROPER METHOD OF INSTALLING EQUIPMENT AND SELECTION OF VALVE BEST SUITED FOR PARTICULAR SERVICE IMPORTANT FACTORS IN SUCCESSFUL BOILER PLANT OPERATION

FOR the purpose of emptying the boiler or ridding it of scum, precipitated scale-forming material and mud blowoffs are provided. These in all instances are of the bottom connected type, although some boilers are, in addition, equipped with those of the surface type for the purpose of removing those undesirable substances which have a tendency to remain on the surface of the water. This latter consists of some form of funnel, made and placed so as to operate regardless of the water level. To give this type a wider range of operation, it is sometimes provided with a float so that the opening of the funnel will at all times be in register with the surface of the water.

Another type of blowoff is that used in connection with the mud drum into which the feed line discharges and where large amounts of scale-forming material precipitate, requiring frequent removal.

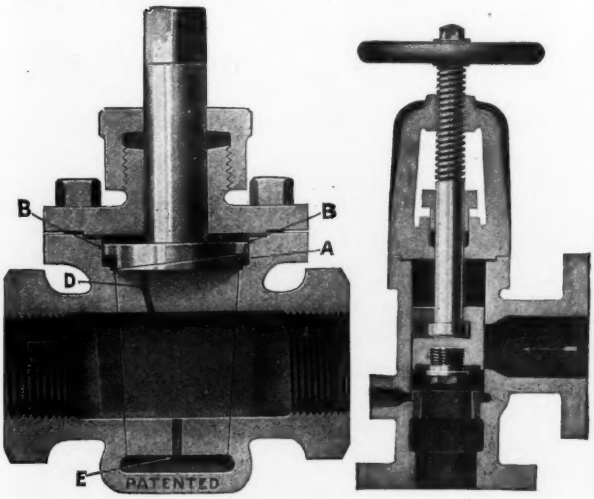


FIG. 1. HOMESTEAD BLOWOFF VALVE OF THE PLUG-COCK TYPE

FIG. 2. FABER BLOWOFF VALVE

Surface blowoffs should not be over 1½-in. pipe, carried through the shell or head with a bushing. For the bottom blowoff which should be connected to the dead water space, the minimum size should be 1-in. and the maximum 2½-in., and for pressures over 15 lb. should be extra heavy from boiler to valve, without bushings or reducers. Globe valves are not to be used and above 125 lb., 2 valves or a valve and a cock must be provided; these are always advisable for any pressure.

The number and size of blowoff cocks are often specified by municipal or state legislation.

VALVES

REQUIREMENTS of a good blowoff valve are that it shall furnish a free passage for scale and sediment, that it shall close tight so as not to leak and that it shall open easily without cutting or sticking. On account of the severe service to which these valves are put, they are usually made extra-heavy, with renewable wearing parts and should be made of material capable of withstanding the action of acids and alkalis and the severe action of superheated steam.

Blowoff valves are made in various styles and types, having, as a rule, straight through flow but with plug, cock, disc or shutter closure. Description of each of these types follows.

An example of the plug cock type is illustrated in section in Fig. 1. This valve, which is of the straight-way type, is so constructed that when closed the plug is forced to its seat by means of the traveling cam A through which the stem passes and which is prevented from turning by means of lugs B moving vertically in slots. E and D are balancing ports allowing the pressure to act at the top of the plug, gently holding it in its seat while the valve is open. The advantages claimed for this type of valve are: quick opening, straight passage, ease of operation and safety.

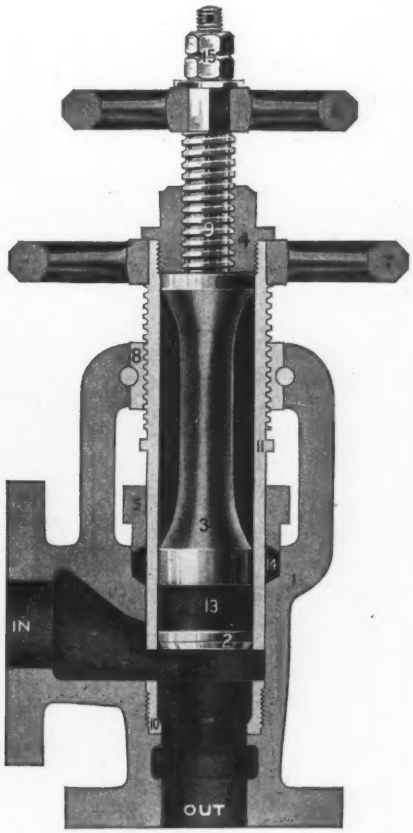


FIG. 3. EYNON-EVANS DOUBLE BLOWOFF VALVE

The flanged Faber blowoff valve shown in Fig. 2 is provided with means for cleansing the disc and seat by a jet of water or steam after the fluid is practically shut off, but before the valve is finally closed.

With the disc in the position shown, the water is practically shut off and any sediment lying on the seat at this instant would remain were not means provided for its removal. Surrounding the seat is a chamber through which steam is introduced at boiler pressure is so designed that when the boiler is being blown down, the anti-leak valve, 11, is protected from the cutting and wearing action of the material being discharged. When worn out, piston 11 may be replaced or repacked while the boiler is under pressure.

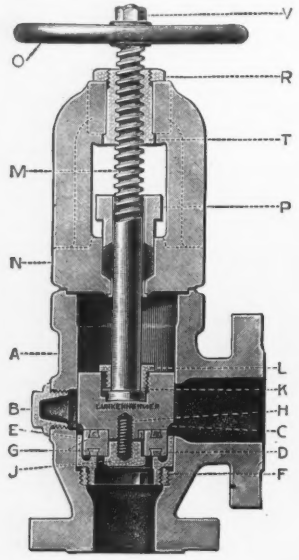


FIG. 4. LUNKENHEIMER "DURO" BLOWOFF VALVE.

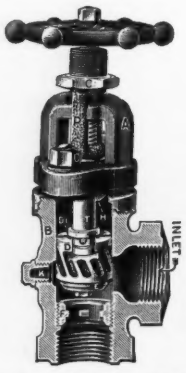


FIG. 5. POWELL PATENT CYCLONE BLOWOFF VALVE

FIG. 6. WILLIAMS IRON BODY STRAIGHTWAY BLOWOFF VALVE

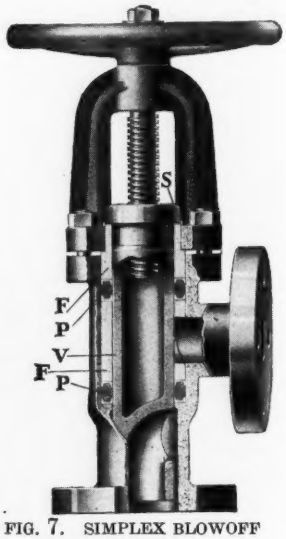


FIG. 7. SIMPLEX BLOWOFF VALVE OF THE SEATLESS TYPE

through a ½-in. connection leading from the steam main and shown at the left of the cut. The outside diameter of the seat is 1/16 in. smaller than the bore of the valve. A 1/32-in. opening all around the seat is thus formed through which the steam escapes from the chamber surrounding the seat and impinges on the disc and seat thoroughly cleansing them from sediment.

An Eynon-Evans double blowoff valve consisting of a main valve, 11, and auxiliary valve, 13, each controlled by separate hand wheels, is shown in Fig 3. This valve

In order to open this valve small wheel 6 is rotated until piston 3 strikes stop 4, after which large wheel 7 is turned to the left to any desired opening of valve 11. To close, the large wheel is turned until piston 11 comes in contact with seat 10, when the small wheel is turned until disc 2 comes in contact with seat 10.

Figure 4 illustrates a Lunkenheimer "Duro" angle blowoff, for working pressures up to 250 lb. with iron body, brass mounted and provided with renewable bronze seats and renewable and reversible discs, both sides of the discs having a seating face made of a lead alloy which may readily be melted out and replaced with new material. Disc D is secured to plug C by stud H and nut J. At the back of the valve is a plug B upon the removal of which any sediment accumulated at the inlet if the valve may be reached and washed out with a hose.

The body and yoke of the Powell Patent Cyclone blowoff valve are of close-grained cast iron and are joined

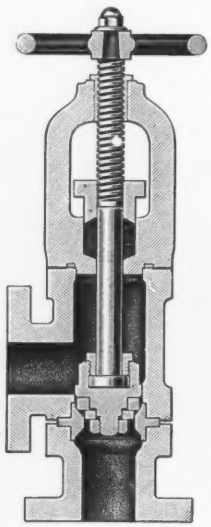


FIG. 8. PRATT & CADY BLOWOFF VALVE

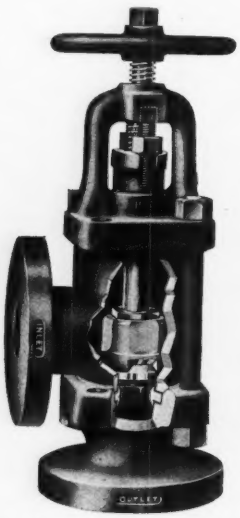


FIG. 9. CADMAN INDESTRUCTIBLE BLOWOFF VALVE

FIG. 10. INTERNAL CONSTRUCTION OF THE EVERLASTING BLOWOFF VALVE

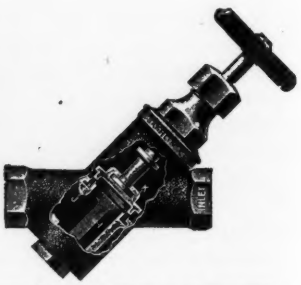


FIG. 11. BASHLIN Y BLOWOFF VALVE

together by heavy bolts and nuts, firmly binding the flanged faces. The valve stem T is of steam bronze composition and the regrindable, renewable and reversible disc E of white "Powellium" Bronze, a metal said to resist corrosion. Disc holder D is of steam bronze composition and is milled to receive the lower collar on stem T. This holder D, fitting snugly in the body, is given a centrifugal motion by the steam striking the spiral grooves cut around the sides, when opening and closing the valve, thus tending to keep the inside walls of the valve freed from scale and deposit.

Seat F is made of white Powellium Bronze and like the disc is regrindable, reversible and removable. To renew or reverse the seat, unscrew it by means of a flat tool of any kind, engaging the lugs projecting from the inner circle.

Packing is secured by a patent pusher gland P operated by the outside screw nut C above the bridge of yoke A.

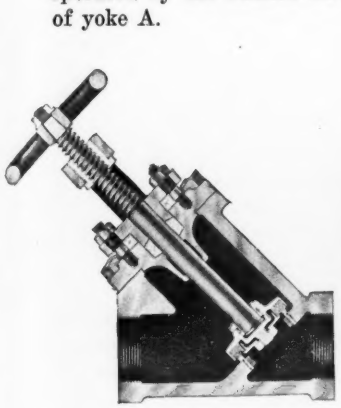


FIG. 12. ANOTHER BLOWOFF VALVE OF THE Y TYPE, THE JENKINS BROS.

FIG. 13. BLOWOFF VALVE OF THE HANCOCK MAKE

The valve shown in Fig. 6, the Williams Iron Body Straightway blowoff valve, has a straightway opening through the body, thus offering little resistance to the free flow of muddy, scaly water.

An annular lip projecting from the bottom of the disc and fitting into the seat ring when the valve is being closed provides for automatic cleansing of the seating surfaces, preserves them against wear and also prevents water hammer. When the valve is being closed, this annular lip in entering the seat ring first protects the seating surfaces from any wiredrawing action and at the same time deflects a thin current of water over the face of the seat, automatically washing off any dirt or scale which may have lodged there.

The Simplex Seatless blowoff valve consists of a heavy iron, bronze or steel body and bronze or steel yoke containing hollow plunger S, follower glands F, and packing P, Fig. 7. By means of a non-rising hand wheel, the valve may be opened or closed by raising or lowering plunger S, which, when in its extreme lower position, causes shoulder S to engage follower gland F, thereby compressing packing P above and below the port, making the valve tight.

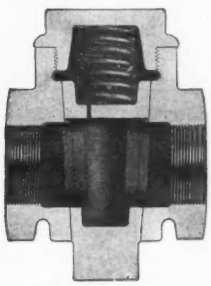
Due to the form of construction employed, it is stated that all valve seat troubles are avoided, thus eliminating that source of expense and trouble.

The Pratt & Cady blowoff valve shown in Fig. 8 has both renewable and reversible seat and disc made of special metal, the seat being at an angle of 45 deg. to prevent lodgment of scale or dirt and being depressed below the inlet opening to protect it from impact of the water when blowing off. This valve has a brass stem and deep and large stuffing box, the bolts of which are hinged, making repacking a simple matter.

A cross section of the Cadman Indestructible blowoff valve is shown in Fig. 9. This valve has reversible seat and disc, the former being of phosphor bronze. Rugged construction makes it impossible for water to leak between the valve body and base and it is claimed that expansion and contraction have no effect.

An example of the shutter closure type of blowoff valve is the Everlasting, the internal construction of which is illustrated in Fig. 10. This valve is composed of a top and bottom bonnet, a disc and a lever and post, and is claimed to be self-grinding and self compensating at all points. It is largely employed in stationary service.

Figure 11 shows a Bashlin Y blowoff valve with renewable disc and seat, the latter of which may be replaced through the plug opening shown. The disc is



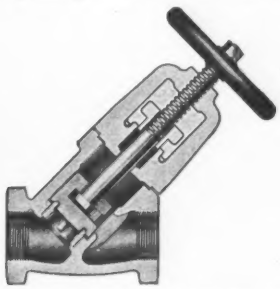


FIG. 14. CRANE EXTRA-HEAVY STRAIGHTWAY BLOWOFF COCK

FIG. 15. CRANE VALVE OF THE Y DISC TYPE

renewed by removing the bonnet, but since it is the seat which is more often damaged, the annoyance of changing discs is greatly reduced.

Another blowoff valve of the Y type having an iron body composition mounted with renewable seat rings is the Jenkins Bros. shown in Fig. 12. A full straight opening offers a practically unobstructed passage for the flow of steam and water and by removal of the top bonnet ready access may be had to the disc and seat.

The Hancock blowoff valve illustrated in Fig. 13 has an iron body, brass mounted, and is furnished with screwed or flanged connections as desired. Disc and seat, both readily removed, are of a special brass composition claimed to be capable of standing severe service and great wear. An important feature of the construction of this valve is the lip-like projection at the bottom of the disc which deflects the steam, or liquid, causing it to pass rapidly over the face of the valve seat, thereby blowing or washing all foreign matter from between the seat and disc. Wire cutting or erosion when the valve is slightly cracked is also prevented by this projection.

Another of the plug type of blowoff valve is the Crane Extra Heavy Straightway blowoff cock shown in sections in Fig. 14. This valve, which is entirely of iron and furnished with screw of flanged ends is provided with a compensation spring below the plug to take

up all wear. It also aids in holding the plug securely in place, thereby preventing the accumulation of scale, sediment, etc., which would tend to impair the ground bearing surfaces of the plug and body.

The Crane line is also represented by blowoff valves of the angle, globe and Y disc types, the latter of which is illustrated in section in Fig. 15. To prevent the necessity of too frequent repairing, these valves are made with a removable iron seat ring having the seating surface on the outside of the ring. The disc is likewise of iron with a throttling lip, which, with the flow of the steam and water, has a tendency to clean the seat and thereby prevent scale and sediment from lodging between seat and disc.

Protection and Piping of Blowoff Lines

Blowoff lines which are in the path of hot flue gases are usually covered with magnesia, asbestos or fire brick, and in the case of forced draft installations, additional measures are taken to prevent the burning away

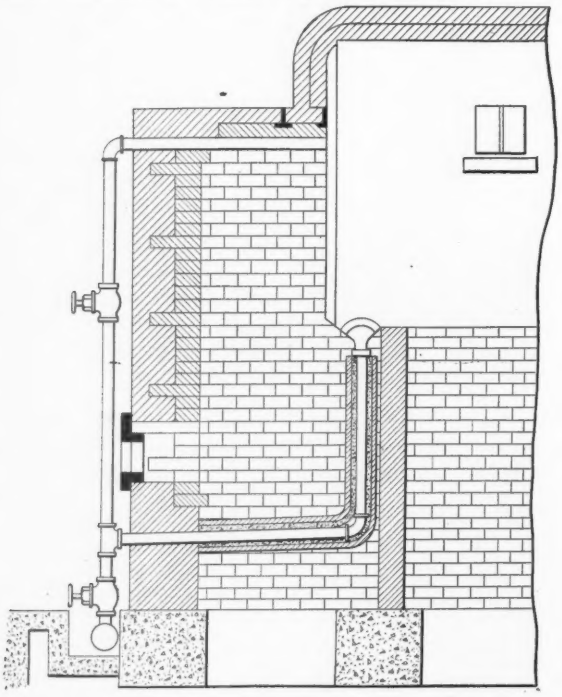


FIG. 16. PROPER METHOD OF PROTECTING BLOWOFF

of the pipe, such as encasing in a larger pipe. In this case, it is desirable to connect the blowoff as shown in Fig. 16, so that while not in use, a continuous circulation of water is maintained through it, thus keeping the pipe comparatively cool.

In some installations and especially so in large plants, the lines joining boiler and header are provided with a blowoff valve and a blowoff cock with the former next to the boiler. In piping up such systems, the several boilers are generally connected to a common header which carries all sediment and water to some proper place of disposal. This may be a nearby lake or stream, or in the case of a large city, it may become necessary to blow into a public sewerage system. But in such cases it is not only advisable but usually required by local ordinance, to connect to a blowoff tank, the sediment and water being blown into the tank and permitted to cool before delivery to the sewer.

This tank may, as shown in the accompanying figure, be a shell with inlet, overflow and vent to the roof, or it may be a pit of brick laid in cement mortar, or of concrete. For tanks the sheet is usually ¼ in. thick and

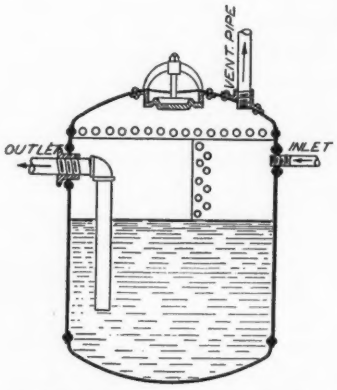


FIG. 17. CONSTRUCTION AND METHOD OF CONNECTING BLOWOFF TANK

joints single riveted. The capacity may well be 1/24 the volume of the boilers, neglecting the tubes, that are to be blown down at one time. Usually, unless there are more than 3 boilers, it will be best to consider that all are to be blown down at once, and allow the tank capacity accordingly.

Lamp Voltage Standardization

In a discussion of voltage standardization before the May meeting of the National Electric Light Association, Douglas Burnett, of Baltimore, stated that at present 94 per cent of all lamps manufactured range in voltage between 110 and 120, there being 4 favorite voltages, of which 110 v. figures 19 per cent, 112 v. 12 per cent, 114 to 116 v. 10 per cent and 120 v. 80 per cent. There is a marked increase this year apparently in the sale of 110, 116 and 120-v. lamps. The records of the lamp companies show that in the past there have been 31 different voltages offered, and Mr. Burnett urged that the Association recommend the elimination of all voltages from 100 to 107, and from 123 to 130 and concentrate for the present on 15 approved voltages, with the urgent endorsement of the gradual adoption of the 3 voltages, 110, 115 and 120 to be labeled preferably with the number and a symbol designating plus or minus 2 v.

Commerce Reports publishes a report which has been made concerning the use of peat powder for the Swedish State Railways. This report discloses the fact that the administration of these railroads has requested the king to propose a bill for an appropriation for the erection of a peat powder factory for the use of the railroads. This form of fuel has been experimented with and proved successful to such an extent that the authorities recommend the expenditure of considerable capital for development purposes.

Mechanical Soot Blowers and Efficiency

Effect on First Cost and Efficiency for Medium and Large Size Power Houses. By Reginald Trautschold

EVERY power house aims to develop its power at the lowest possible rate—that is economy; and every power house is equally desirous of conserving its resources and of securing the greatest possible return from each dollar expended—that is efficiency. Any mechanical device which can further either of these aims is a power house asset and any device which appreciably furthers both becomes a power house necessity.

Formation of soot cannot be prevented under the conditions existing in a boiler furnace, it is formed at a rate as rapid and as constant as that at which the coal is burned—the quantity only differing with the grade of coal and the construction of the boiler and grate.

So harmful are the results to the efficiency of the boiler that a coating of soot but 1/32 in. thick would make futile the burning of nearly 200 lb. of coal out of each ton fed to the grates. A coating of soot 1/8 in. thick, not an unheard of condition in some neglected power houses, would be about as disastrous to economy as would throwing away half the coal.

Ridding the boiler heating surfaces of coverings of soot is then a necessity, if the boiler efficiency is to be maintained anywhere near what it should be.

Operating requirements naturally limit manual cleanings to periods of no load or when the load on the boiler is light. This means that the comparatively clean boiler is used under light load, when the consumption of fuel is low, and the heavier demands on the boiler occur after the heating surfaces have become more or less recovered with soot.

These limitations can be overcome almost entirely by the mechanical soot blower, which is situated within the boiler setting, avoiding chilling effect, and is usually furnished with a number of steam jets accurately trained so as to remove the maximum proportion of soot, thus greatly cutting down the time required for the cleaning process.

All the attendant has to do is to open the steam valve and, if the blower is of the revolving type used on fire-tube boilers, turn a conveniently located handle. The action of the blower is so rapid that the disturbed soot does not re-settle on the heating surfaces but is swept from the boiler. Also of great advantage is the ability to clean the boiler at frequent intervals without appreciable interruption to its normal operation. The boiler surfaces may be blown while the boiler is under any degree of load and the increased steaming capacity thus realized more than compensates for the small amount of steam so used.

Improvement in economy depends upon whether the improved efficiency can be realized without a corresponding increase in the net cost of power production—such net cost taking into account the cost of the blower, its installation, etc. If it can be shown that the mechanical soot blower proves an actual economy in the average size power house—one of a few hundred horsepower capacity—it will mean far more than if its cost, etc., limited its use to the large plants developing thousands of horsepower. To ascertain this important point, the net cost of producing power in any plant must be considered.

All factors affecting the cost of power may be divided into 4 groups; the "fixed charges," consisting of interest on the investment, depreciation, etc., on the equipment, property and so forth; the cost of attendance; the cost of supplies, such as oil, waste, etc., and the cost of the coal. These expenses are common to all power houses but vary in proportion with the capacity of the plant. The "fixed charges" are proportionally at a minimum for a power house of 500 or 600 hp. capacity operating on expensive coal. A plant of such size may be taken as representing about the average power house. With coal commanding a high price, the "fixed charge" factor may constitute but about 25 per cent of the total cost of power. The other extreme, the maximum "fixed charge," is carried by plants of thousands of horsepower capacity operating on very cheap coal and may be as much as 60 per cent of the total cost of power.

The proportional cost of attendance is somewhat less in large plants than it is in very small power houses, but for a power house of average size—500 to 600 hp. capacity—it is very nearly the same as for large plants, about 15 per cent of the total cost of power. The cost of supplies, etc., varies closely with the capacity of the plant, so may be taken as being about proportionally constant, so far as it affects the cost of power.

The proportional cost of coal required for power development affects the total cost of power in a way almost diametrically opposed to the effect produced by the fixed charges; that is, the coal item is proportionately at a minimum in the large plant operating on cheap coal and at a maximum in a plant of 500 or 600 hp. capacity burning expensive coal. In the large plant burning cheap coal it may be as low as 25 per cent of the total cost of power, while in the average size plant operating on expensive coal it may be as much as 60 per cent of the total cost of power.

Numerous installations of mechanical soot blowers have shown an improvement in boiler efficiency represented by a saving in coal consumption of 10 per cent or more—so that a conservative figure to place on the improvement in power house efficiency brought about by the mechanical soot blower would be 5 per cent.

Favoring the manual methods to the utmost, their cost will be overlooked and the expenses entailed in the purchase of the mechanical soot blower and in its installation, etc., simply added to the fixed charges burden of the power house. Extremely liberal estimates would add 1/2 per cent to the fixed charges for the average plant and, to be equally conservative, 1/4 per cent to the fixed charges of the large plant.

In the power house of average size operating on expensive coal, the fixed charges factor being 25 per cent

of the total cost of power, the mechanical soot blower would add not more than 0.125 per cent, by reason of its initial cost and the expense of installation, to the total net cost of power. Against this would be credited a saving of about 3 per cent in the cost of the necessary fuel—the cost of coal representing 60 per cent of the total cost of power and the mechanical soot blower credited arbitrarily with an average saving in coal consumption of 5 per cent—so that the net economic value of the mechanical soot blower to such a plant would be measured by a reduction of at least 2.875 per cent in the net cost of producing power. In the large plant operating on cheap coal, to take the other extreme, the fixed charge factor would be increased by 0.25 per cent —that is, 0.15 per cent added to the net cost of power— and the cost of coal reduced 1.25 per cent, so that the net economic value of the mechanical soot blower to such a large, economically-operated plant would be measured by a reduction of 1.1 per cent in the net cost of power. This, in a power house of 5000 hp. capacity, would be about equivalent to a reduction of $4600 in the cost of the plant.

The mechanical soot blower has then made possible increased efficiency of at least 5 per cent in almost any power house, a record which has been made time after time in every class of power house, and makes possible material improvement in the economy of operation—an improvement which is much more marked in the power house of average size than in the very large power houses.

The mechanical soot blower should certainly be classed as a power necessity and a necessity which is much more valuable to the average size power house than it can be to the very large ones. The large and wealthy power houses naturally demand the mechanical soot blower—the assured saving making the investment imperative—and the smaller average size power house cannot really afford to be without such equipment, the assured saving being well worthy of the necessary investment.

Industries When Peace Comes

IT IS no good turning over for a comfortable nap because prosperity is upon us, some of it engendered by abnormal activity in war supplies. If we wake up, rub our eyes, cock our ears, "stop, look and listen," the signs of tremendous industrial competition when peace arrives will be evident on every hand. While there will be needed great amounts of equipment to replace that destroyed by war, it is reasonable to expect that each country will, so far as possible, endeavor to supply its own needs, as a matter of economy and to give employment to its own citizens. Further, every effort will surely be made by each nation now at war to secure all possible export business in order to keep its industries busy and to help pay its war debt. Since there will be restriction of trade both by sentiment and by government regulation between the countries now at war, their struggle will be for trade with the nations now neutral, those nations to whom we must look for export trade, as the effort of the warring countries and the depletion of their wealth will limit our trade with them after the war.

As an evidence of the measures whose efforts we must meet, the United Kingdom has adopted resolutions to prevent importation of enemy goods through neutral or allied countries; to prevent shipment of raw material to enemy countries; to teach applied sciences in the secondary schools and in the leading universities; to adopt the metric system for trade with countries using that system; to introduce decimal coinage; and to favor daylight saving. All these point to intensive preparation for a trade struggle that will be as determined as the physical war now in progress, and it will be against the whole industrial world, even though the greatest aggressiveness may be directed toward Great Britain's present enemies. Germany will certainly retaliate, and will also contest for trade of the world against all comers, hence our own competition will be with both these powerful interests. We cannot hope to succeed if we insist on maintaining high costs of production either by large returns on investments or high rate of payment for services. There will be necessary economic readjustments for both employer and employe, and only by recognizing that fact, and working together to retain our share of the world's commerce ran the competition be met and our industries kept in thriving condition. We are one of the neutral countries whose markets will be invaded, and the business of supplying our own needs will have to be guarded, as well as endeavoring to retain our foreign trade.

THAT THE SAME complete and prompt publicity may be given to the determinations of the Commissions that regulate public service corporations, as has been demanded from the corporations themselves, the Public Service, Railway and Corporation Commissions of the several states, through the National Association of Railway Commissioners, of which all the State Commissioners are members, have arranged for the official publication of all State Commission decisions, under the title "Official Public Service Reports." This publication will not only have the advantage of being official, but will be entirely complete and the decisions will be issued with much greater promptness than ever before.

The problem of keeping currently informed as to the progress of and changes in commission regulation and public service activities in every part of the country is solved by weekly publication and a complete index-digest in each weekly number, simply and effectively arranged, enabling every department head in a public service company, as well as every public service lawyer and commissioner to locate readily, from week to week, all the current material in which he is interested. The editorial and publishing offices have been established in New York City, at 74 Broadway, and the first volume of 1916 decisions has just been issued.

U. S. CIVIL SERVICE COMMISSION announces examinations, July 5-6, (1) for copyist structural steelwork draftsman, to fill 3 vacancies in the Bureau of Yards and Docks, Navy Department, Washington, D. C.; (2) for heating and ventilating engineer and draftsman in the Office of Supervising Architect, Treasury Department, Washington, D. C. Photographs must be submitted to the examiner. Apply for Form 1312, stating the title of the examination for which the form is desired.

Electrical Machinery and Appliances

For Generating, Transmitting and Using Current

Short-Circuit Current of Alternators

RESULTS OF TESTS SHOWING BEHAVIOR OF SINGLE AND 3-PHASE MACHINES. BY F. T. HAGUE

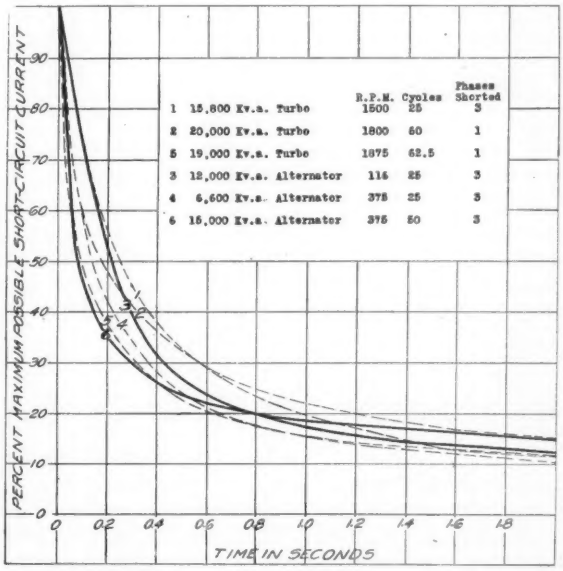
WHEN an alternator is short-circuited the current rises during the first cycle to a maximum value, and then rapidly decreases to a constant value, known as the "sustained short-circuit current." Generally speaking, this transient rush of current is due to the fact that the armature synchronous impedance cannot rise instantly to its normal value, because time is required for the armature reaction to take its effect on the field.

Synchronous impedance combines the effect of inherent or leakage reactance and armature demagnetization. The armature current tends to demagnetize the main field. The main field, however, represents a definite amount of stored energy which cannot be demagnetized instantly, but only at a rate depending on the effective resistance and self-induction of the paths through which it may discharge. Thus, at the instant of short-circuit, the effective synchronous impedance consists only of the inherent reactance and, as time progresses and demagnetization becomes effective, the synchronous impedance increases rapidly and reaches its normal value when the armature current reaches its sustained value.

The current in at least 2 of the phases of a 3-phase machine will always be unsymmetrical at the instant of short-circuit. The period for which this dissymmetry exists depends upon the electrical characteristics of the windings. On most machines the waves become practically symmetrical in from 0.15 to 0.25 sec.

The dissymmetry of the phase currents is usually explained mathematically. It is possible, however, to obtain a physical conception of this phenomenon by the application of the fundamental rules governing flux, voltage and current. The phase winding which is located midway between the field poles at the instant of short-circuit will have a maximum of unsymmetrical current induced in it, because it is situated so as to receive the fullest effect by transformer action of the rapidly decreasing field flux. The field flux, under the variable demagnetizing action of the unsymmetrical armature current, undergoes a cyclical variation in magnitude (as may be seen from oscillograms of field currents), so that all phases successively passing the poles do not have the same unsymmetrical current (voltage) induced in them. The phase winding situated at the center of the pole at the instant of short-circuit is on the magnetic axis as far as this cyclical oscillation of field flux is concerned, so that it has no unsymmetrical current induced in it. The unsymmetrical currents are not due to any flux distortion in the air-gap, but are rather the effect of the field flux discharging through the armature circuit. The sum of the maximum values of current in the first 2 alternations is nearly the same for all phases.

The effective resistance of the field circuit changes considerably while the field is being demagnetized. The eddy current and other losses incidental to the rapidly changing flux and large currents produce a watt loss equivalent to an increased variable resistance, which cannot be measured under normal open-circuit conditions.



CURRENT DECREASE ON UNSYMMETRICAL SHORT CIRCUITS

A resume of a number of tests on various types of alternators showed that the transient component of the short-circuit current did not follow any simple logarithmic law as might have been expected, probably as a result of the change in the effective resistance in the field circuit. Single-phase short-circuits showed a considerably faster rate of decrease of current than polyphase short-circuits in the same machine. For equal currents

per terminal the polyphase short-circuit has roughly 50 per cent greater demagnetizing ampere-turns than the single-phase, so that the faster rate of decrease with the single-phase condition would indicate sufficiently high additional losses (or the equivalent of high resistance) such as usually accompany single-phase armature reactance, to offset the greater demagnetizing strength of the 3-phase armature reaction.

The effect of a damper winding on the rate of decrease, due to its ability to prevent rapid change of field flux, is not apparent from tests. If the main field does not change so rapidly when encircled by a damper, then the current induced in the armature by the transformer effect of the decreasing main field is lessened, while the electric motor force due to rotation is maintained, so that the total effect on the magnitude and rate of decrease of current is little, if any.

Considering the widely different electrical and mechanical characteristics of the prevailing types of alternators (slow-speed engine type, water-wheel and high-speed turbo-generators), it would scarcely be expected that any one simple rule for the rate of decrease of current after short-circuit would apply equally well for all classes of machines for both 25 and 60 cycles. Comparing different oscillograph tests on the same machine, it is seldom that the same degree of dissymmetry has been duplicated in any 2 tests. In order to form a basis of comparison, it was necessary to compare all machines either on the basis of symmetrical short-circuits, or on the other extreme basis of totally unsymmetrical short-circuits. By a totally unsymmetrical short-circuit is meant one in which the first current cycle takes place above the zero line. This latter basis was adopted, as it apparently represents the most severe conditions on the machine and its auxiliary circuits.

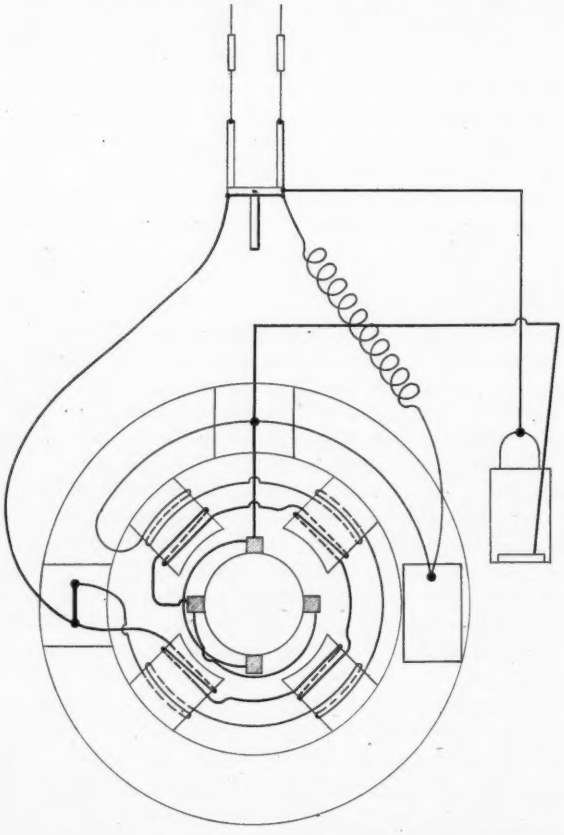
The rate of decrease of maximum possible instantaneous current on a totally unsymmetrically short-circuit is shown in Fig. 1 for a few typical machines of the salient pole alternator and distributed field winding turbo-generator type, for both 25 and 60 cycles. These curves include single-phase and polyphase short-circuits on machines with and without damper windings. Many more tests could be shown that fall within the limits shown on the curve.

It is not commercial practice to take oscillograms covering a period of time greater than from ¼ to ½ sec., except in special cases. A considerable portion of the data available consisted of short-time tests, and in such cases it was necessary to determine the equation of the curve of current decrease and to extrapolate it. The diversion of the transient component of current from any simple logarithmic law was very marked in all of these curves, especially during the first ¼ sec. The test conditions under which this data was obtained differ from the conditions found on commercial circuits, in that the machines tested were not equipped with automatic voltage regulators. The effect of a regulator is to increase the sustained short-circuit current to several times the value shown, without making any appreciable difference in the rate of decrease of current during the first few seconds.—The Electric Journal.

Emergency Motor Starter

By Receiver

On a compound motor, the starting box was so damaged in shipment that it was useless, and to obtain another would require weeks. To get the motor in operation without loss of time, a water resistance was used, erected as shown in the figure. One side of the main line switch was connected, in the usual manner, to the armature, while one connection from the other side of the line was carried directly to the shunt field as indicated. Current for the armature was led to a water resistance consisting of a 3-gal. galvanized iron



WATER RHEOSTAT SHOWING CONNECTIONS IN MOTOR CIRCUIT

water pail, the lead from the main switch having the end clean, was wound around the handle of the pail, as snugly as possible, and then firmly soldered. The line from the armature brush was connected to the lining of a fire door, with sufficient slack to give 3 or 5 ft. play. The pail was filled to within 2 in. of the top with water, into which a handful of salt was put.

To start the motor, the line switch was closed and the fire door lining gradually lowered into the water, the motor starting as soon as the iron plate was immersed, and gradually increasing in speed until it reached full speed, when the iron plate rested on the bottom of the pail and all resistance was cut out.

Care must be used in all cases of such temporary resistance, that this resistance is in the armature circuit only, and that the shunt field is directly connected to

line, otherwise the field will be weakened by taking less current from the line, resulting in a weakened starting torque and increase in the armature current.

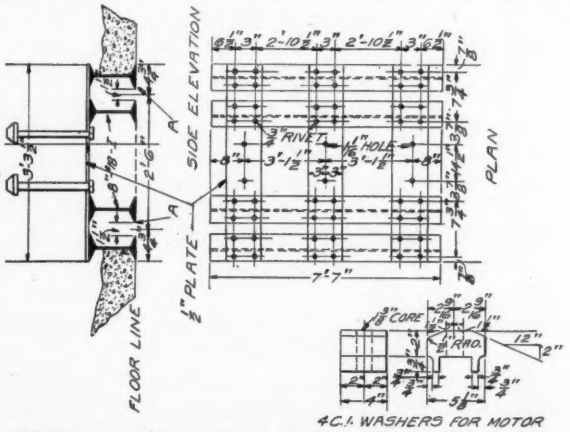
Such a makeshift can be used for motors up to about 30 hp. capacity. It will be noted that the series resistance, in this case, was connected on the side which had direct connection to the main switch. In case of a shunt motor, the same apparatus would be used, but there would be no series coil.

Motor Foundation Frame

By F. G. C.

WHEN an electric motor belt has stretched such an amount that the machine can be drawn back no farther on its bed plate, it generally means cutting and resplicing the belt. This involves more or less expense and trouble and to avoid it as much as possible I devised the following form of construction, which I now employ on all new installations.

Take 4 8-in. No. 18 I beams which cut, drill and bolt together as shown, using ½-in. iron plates 6 to 8 in. wide for the purpose; the anchor bolts may be of any required length and diameter. The top of the foundation is at a height such that when the assembled frame is placed thereon the tops of the beams will be at the same level as the floor line. The motor and bed plate is then placed



DETAILS AND ASSEMBLY OF MOTOR FOUNDATION FRAME

on this frame and bolted down by means of bolts passing through the slots at A, the bolts being prevented from turning by cast-iron washers of the form shown.

Place motor and bed plate as far to the front of the frame as possible and adjust length of belt accordingly. As the belt stretches the motor is moved back on the bed plate until it reaches the end of its travel after which further stretch is compensated for by moving the motor forward on the bed plate and the bed plate backward on the frame. The belt will now be tight without cutting and resplicing.

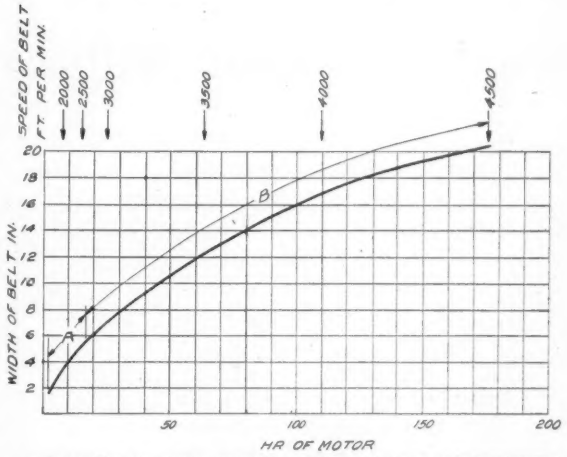
This arrangement has satisfactorily handled a 125-hp. motor driving a 150,000-cu. ft.-per-min. Sirocco fan employing a 20-in. belt and with 85 ft. between pulley shafts.

The figures and dimensions shown in the accompanying illustration apply only to a particular case and will of course require change to meet local conditions and requirements.

Motor Pulleys and Belts

By N. G. Near

HEREWITH is shown a chart which gives sizes of pulleys and belts commonly used with electric motors. It represents average practice although there is no reason why belts on small motors cannot be run at as high speeds as or even higher than those on



RELATION OF BELT WIDTH TO SPEED AND HORSEPOWER

large motors. Appearance probably has much to do with the usual sizes adopted. In the range marked A, the pulley is usually made ½ in. wider than the belt, and in range B, 1 in. wider.

Band Wires Broke

By E. C. Parham

THE immediate effects of decreasing the air gap of a generator, are to decrease the field current required to give normal voltage and to increase the effect of armature reaction, thereby increasing the tendency to spark when load is put on. The effects of increasing the air gap of a generator, are to decrease the effect of armature reaction, thereby decreasing the tendency to spark with load and to increase the field current required to maintain normal voltage under operating conditions. There is no objection to increasing the air gap for commutation improvement or for any other good reason, provided the resulting increase in field current required is not so great as to cause unsafe heating of the field winding and provided that normal voltage is obtainable after the change.

An operator complained of band wires breaking. An inspector plowed his way through snow to the place of trouble and found that bearing wear, incident to oil freezing, had let the armature core down onto the pole pieces which had rubbed off 2 bands; as safety factors, which later proved to be otherwise, the operator had put in a set of bearings the linings of which he had had bored above center to increase the clearance in the bottom gap; he also had increased the size of the binding wire to strengthen it. The result of these apparent factors of safety, was that the bands jammed the poles as soon as the armature was installed.

The operator frankly acknowledged his responsibility and expressed his approval of any measures that would get the machine into operation without delay. As rebanding of the armature or rebabbiting of the bearings was out of the question under the conditions, the inspector removed the 2 top pole pieces and ground off 1/16 in. with an emery wheel. The pole pieces were then replaced and the machine placed in operation, and everything seemed to be all right.

Some Big Fishing and Little Jacks

CLEARING WATER PLANT TRASH RACKS AND JACKING OVER A THRUST DISK IN CLOSE QUARTERS. BY G. H. KIMBALL

RICHARDS was telling of the trouble that the intake screens for the cooling water for the condensers was giving, when Chief Wallace remarked:

"It makes me think of how the head gates used to get plugged up after the usual spring floods at the Glendale power station.

"It's not an experience you would expect to meet in engineering work but it just shows how many different things an engineer is sometimes called to do.

"Whenever the water was high in the river, it always seemed to find something on the banks that had been left there since the last high water to bring down, so when we would find that there was not much water running through I would get the line gang to help and we would go up there and see what we could pull out."

"How could you get a hold when the water was so deep?" asked Richards.

"Oh, the material was mostly branches and small logs with leaves and old rags packed in around them by the flow of the water. Where a part of a branch showed above the surface, we would hitch a chain to it and then try light falls and pull up straight into the gate house; if it was too heavy to move this way we would use a heavier tackle and pull up the bank. After one experience at this, I had some long hooks made and also a heavy one. Then we would take the long hooks and fish in the water until we caught something, and then if we could get it above the water enough to use the heavy hook, it could usually be pulled out."

"What would happen, if some of the debris went into the canal?" asked the oiler.

"It often did that," replied the engineer; "and then it would lodge near the rack, along with considerable sand. That was also a yearly occurrence to have the sand about 10 ft. deep near the rack."

"Was it hard to get that out?" asked Richards.

"Not very, for we would open the waste gate and it would wash out. We did that every summer when we inspected the inside of the wheels."

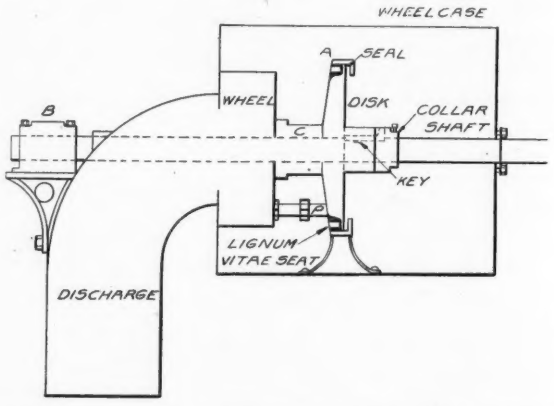
"What other trouble did you strike with water wheels?" asked the interested oiler.

"I remember one," said the engineer, "that was a real job to get fixed.

"All horizontal runners have an end thrust one way or the other and some have collars on the shaft to hold the runner in place, while some have 2 runners thrusting against each other so that the force of one is neutralized by the other. Those in the Glendale plant had a device called a water cushion that used the pull of the draft tube to hold the runner in the right position. The inside of the wheel case was like this" (see sketch), "and the part containing the runner and the arrangement in front marked *A* is the water cushion.

"One day I noticed that the end of the shaft was sticking out of bearing *B* farther than it should, and thought something was wrong inside, so I wrote to the wheel company about the matter, telling them what I had seen. They said that the seat in the water cushion had probably worn out and as it was made of lignum vitae blocks, they would send me a set.

"When Sunday came I drew off the water and got inside, and found it was as they had supposed. Then the next thing was to find a way to get the blocks in



INTERIOR OF WHEEL CASE SHOWING THE WATER CUSHION TO TAKE END THRUST

to the recess made for them in the casting *A*. First, I worked on the side next to the wheel and after taking out several bolts which came out very hard, I found that I was no better off so far as moving back the seat was concerned and, as the day was nearly gone, I decided to look for more information before trying it again. The hub of the disk had the collar next to it as shown and I thought that it was shrunk onto the shaft.

"But the company set me right about that matter and sent a drawing showing the key as you see here with the head under the collar. This made the matter plain, so the next Sunday I went at the work again and this time it was an easy matter to find the key, which came out without trouble, and then we tried to move the disk back from the seat so that the worn blocks could be removed and the new ones put in."

"How could you get to the blocks that form the seat?" asked the oiler. "It looks from the drawing as if the seat was all covered up."

"It was all covered by the casting *A* and we had first to remove this, which brought the outer edge of the disk and seat to view. The disk was not very thick, so we couldn't put any great strain on the outer part of it and as it was a very good fit on the shaft, we worked

until 4 o'clock in the afternoon without moving it any. Then I made some little jacks out of 2 7/8-in. bolts and the nuts. These I could get into the space between the hub and the casting marked *C*.

"These we operated with long wrenches and while they would move the disk only the thickness of a nut, after which it was necessary to put pieces of metal under them, yet the disk moved with every turn of the wrenches so that we soon had it where we could renew the seat. After that the job was easy to finish."

"Did you find why the seat wore out?" asked the oiler.

"We found the pipe *P* leading to the tail water plugged with sand and this could have caused the trouble, although the seat would be likely to wear out anyway after a few years' running," answered Wallace.

Pumping Out an Ammonia System

COMPLETE PRACTICAL DIRECTIONS AND PRECAUTIONS FOR PERFORMING THIS COMPLICATED OPERATION. BY THOS. G. THURSTON

PUMPING out the different parts of the ammonia refrigerating plant, while being a comparatively simple operation, is considered quite a feat by many operators. To the beginner, the pumpout lines and bypasses in a large system with their many valves and cross connections is a complicated maze of potential trouble and grief. Many of the more experienced operators have little better conception of the uses of the pumpout connections. I remember one in particular that claimed to have erected or operated nearly every plant of any importance in the United States.

A joint in the discharge line began to leak and it was impossible to stop it by tightening the bolts, so it was decided to put in a new gasket at once. This engineer was in charge at the time and he was told to go ahead and pump the line out so the steamfitters could get at it.

In about 15 min. he reported to the steamfitters that he had pumped out and everything was ready for them to go ahead.

The steamfitter, however, being an old hand at the game, went into the engine room and took a look at the head pressure gage on this line. It registered something over 100 lb. Turning to the engineer, who had followed him, he said: "I thought you said you pumped out."

With a look of pity at the steamfitter, he replied: "Sure, can't you see the back pressure is a vacuum yet?"

The steamfitter wanted to know how he proposed to put the new gasket in the line with the pressure on. Why, that was easy.

Picking up a wrench and a chisel, he loosened up the nuts on the bolts and driving the chisel in between the flanges of the joint he spread them open and let the ammonia in the line between the condenser and the machine blow to the 4 winds. Very simple indeed if ammonia did not cost anything.

PURPOSE OF BYPASS

NEARLY all ammonia compressors are provided with bypasses or cross connections between the suction and the discharge. By opening the valves in the bypasses and closing the main suction and discharge valves the action of the machine is reversed, the discharge line becoming the suction line and the suction line the discharge line. From this it is evident that the discharge side of the system can be pumped down as readily as the suction side, only it is slower because the bypasses are much smaller than the main lines.

In addition to the bypasses on the compressor, there is in every modern installation a separate pumpout line connected from the suction side of the machine to the pumpout header on the condenser and sometimes to the liquid receiver. If there are several machines in the plant each machine is connected to this pumpout line so any machine can be used for pumping out.

PROVISIONS FOR PUMPING OUT

FIGURE 1 is an elementary diagram of the connections in the average plant. A and B are the suction and discharge stop valves respectively, C is the discharge line. D is the stop valve in the discharge line at the condenser, O is the condenser gas header, E, E, E are the gas stop valves on each individual condenser coil and F, F, F are the liquid stop valves at the other end of the coil, P is the liquid header, G the valve in the line leading to the receiver and H the valve in the liquid line R leading to the expansion coils. I is the valve at the other end of the line; sometimes this is omitted. S is the liquid header at the expansion coils, J the expansion valves and T the suction header. L is the valve in the suction line at the expansion coils, U the suction line, M the automatic checkvalve in the suction line. This is not found in many of the older installations.

One and 2 are the compressor bypasses, 3 is the discharge check bypasses, 4 is the stop valve at the compressor in the pumpout line 8, 5 is the stop valve at the other end, 6, 6, 6 are the pumpout valves on the individual condenser coils and 9 is the pumpout header; 7 is the automatic check valve bypass.

CLEARING THE SUCTION LINE

SUPPOSE now we wish to pump out that section of the suction line between the machine and the valve L. The most obvious method is to shut off the feed to the expansion coils by closing valves H, I or the expansion valves J and then closing the valve L and pumping the line down. By this procedure, however, all the liquid left in the expansion coils will evaporate and accumulate considerable pressure.

If the valve L is not absolutely tight, trouble will be experienced from leakage; in fact, it may be impossible to pump it down and keep it there. The better way is to close valve H at the liquid receiver, pump expansion coils, liquid line and all down to zero a

couple of times, then shut the expansion valves or the valve I and the valves K at the suction header. This will leave the coils with very little pressure in them. Now pump down the suction header and suction line to the highest obtainable vacuum and then close valve L. If the job has been thoroughly done, no trouble should be experienced from leakage.

To Pump Out Expansion Coils

Suppose we want to pump out one of the expansion coils. We proceed the same as before to begin with and pump down the coils a couple of times; now close the expansion valves on all the coils but the one to be

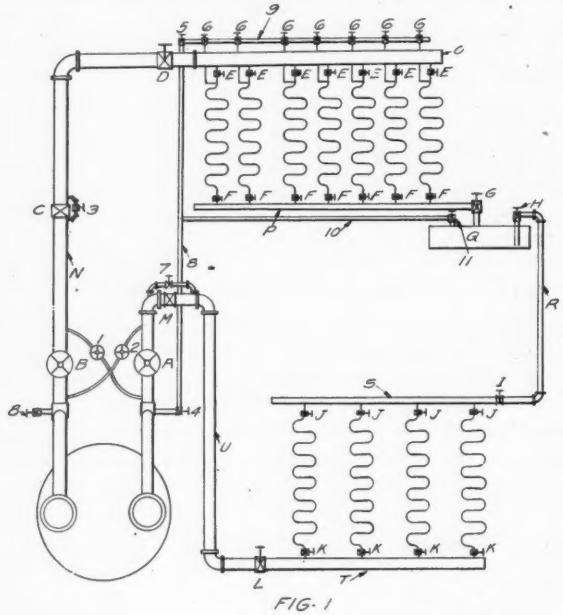


FIG. 1

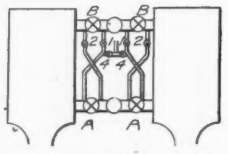


FIG. 3

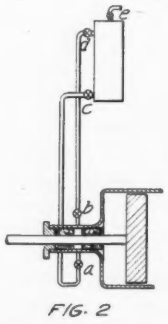


FIG. 2

FIG. 1. DIAGRAM OF AMMONIA CONNECTIONS IN AVERAGE PLANT

FIG. 2. OILING SYSTEM FOR STUFFING-BOX

FIG. 3. BYPASS CONNECTIONS FOR A DOUBLE SINGLE-ACTING YORK MACHINE

pumped out and also the suction valves K and the valve I in the liquid line. Now pump the coil down as far as it will come a couple of times and if the pressure stays down after the last pumping shut the expansion valve J and the suction valve K. If the valves J and K on this coil are tight, the other coils can be started again as soon as the coil is cut out. If all the coils are to be pumped, as for instance in overhauling a brine tank, pump down to zero first, liquid line and all, then close valve I in the liquid line and pump down as low as possible, several times if necessary, until the pressure stays down when the machine is shut down. Then close the expansion valves J and the valves K and valve L.

Liquid Header and Line

To pump out the liquid header S, close valve H at the receiver and pump down to zero a couple of times. Then close the expansion valves J and valves K on all coils, but one. Now pump the liquid line and header down as far as it will go, through the one expansion coil. If the pressure stays down, shut the expansion valve J on the coil used for pumping out and the valve I in the liquid line; if it does not, pump it down again. Liquid lines and headers that are covered generally pump down very slowly, as the liquid in the line can only be evaporated by heat getting to it and this takes time when the line is covered.

To pump out the liquid line R, close valve G and pump expansion coils, liquid line and receiver down to zero. This may have to be repeated one or more times. Then shut off all the expansion coils but one, as in pumping out the liquid header, and pump down the line and receiver through one coil. The reason for not pumping down through all the coils is that it takes longer and there is always a chance of drawing air into the system when pumping a vacuum and therefore it is advisable to keep the pressure in the coils at zero, or above on all those not necessary for the operation.

The reason for pumping out the receiver with the liquid line is twofold: first, to reduce the pressure on the valve that shuts off the line as in the preceding cases, to eliminate trouble from leaky valves; second, to use the receiver as an evaporator for the liquid ammonia in the line. The liquid line is generally at a higher level than the receiver, consequently the liquid will drain back into the receiver and as this is generally uncovered, it will evaporate more readily.

In many cases, a separate connection is run from the pumpout line to the liquid receiver. In this case, the line can be pumped from both ends at once for the first pumpout and finished with the pumpout line. All that is necessary is to open valves 4 and 11 in the pumpout line and go ahead same as before. When the line and expansion coils have been pumped down to zero close valve I in the liquid and the suction stop valve A and finish the job with the pumpout line.

Liquid Receiver

Pumping out the liquid receiver is done in practically the same way. If valve G leaks all the liquid valves F on the individual condenser coils must be closed and the liquid header, P pumped down with it. If some of the valves F leak, as happens many times, close valves E at the other end of the coil having the leaky liquid valves, open the liquid valves wide and pump the coils down with the liquid header and receiver. This can only be done when the condenser is a large one and the coils cut out from only a small portion of the total. If, for instance, 2 coils were cut out on a 3-stand condenser, there would not be room enough left for storing the pumped out ammonia in the

remaining coil. In this case, the whole condenser would have to be pumped and the ammonia stored in the expansion coils. We will come to that later.

The liquid header P can be pumped out the same way or it can be pumped out through one of the condenser coils by means of the pumpout line.

Condenser Coils

To pump out a condenser coil, we use the pumpout line. Close valves E and F at the gas and liquid ends of the coils, respectively. Open valves 4 and 5 in the pumpout line and valve 6 on the particular stand that is to be pumped out. If the pumpout line is connected at the bottom of the condenser coils instead of the top open valve 6 very little at first because the coil may be pretty well filled with liquid and if the valve is opened up wide, it will rush right back to the compressor and may cause trouble. If nothing else, it will freeze the machine up.

A better way is to open valves 5 and 6 wide and opening valve 4 last, use it for regulating the same as an expansion valve. The machine is kept working as usual, until the coil comes down to suction pressure, which is indicated by the frost forming on the coil. Keep on pumping until the frost disappears again. This is an indication that all the liquid is evaporated and nothing but gas remains in the coil. Now slow the machine down and close suction stop valve A. The machine will now be working on the pumpout line alone and it will only take a few minutes to pump the remaining gas out of the coil. Now close valve 4 and open A and the machine is ready to resume normal operation again. Close valve 6 on the pumped out coil as soon as possible after pumping out as sometimes the pumpout valves on the other stands leak and the coil will fill up again.

In pumping out coils on a double pipe condenser be sure to keep a strong circulation of water going through the coil or shut the water off and drain it. Otherwise the coil may freeze up and split a pipe or crack a return bend off.

The liquid header, receiver and the liquid line can be pumped out this way if desired. For instance, to pump out the liquid header shut all the liquid valves but one on the condenser coils and shut the gas valve E on this coil and open the pumpout valves same as for pumping out a coil. Keep the machine running same as normal until the back pressure comes down to zero, then close valve G at the liquid receiver, slow down the machine and close the suction valve A at the machine and finsh the job with the pumpout line. When the header is pumped out, shut the liquid valve F on the coil used for pumping out and the pumpout valve 6.

To pump out the condenser, shut the machine down, open the expansion valves wide and let the pressure equalize; the idea is to get the ammonia over into the expansion coils. Now shut valve H on the liquid receiver, open bypass valve 3 on the discharge check valve C, shut discharge and suction valves A and B and open bypass valves 1 and 2. The action of the machine is now reversed, drawing gas from the discharge line and discharging into the suction line. With some types of automatic suction check valves, it is also necessary to open bypass valve 7 as this valve closes when the discharge pressure drops below a certain point. When the condenser is pumped down to the desired pressure, shut valves 1 and 2 as soon as the machine stops and then shut valve D in the discharge line at the condenser and G on the liquid receiver.

Starting After Pumping Out

In starting up after pumping the charge into the expansion coils great care must be taken in handling of the suction valve A. If this is opened too rapidly a large volume of liquid may be carried back with the gas and wreck the machine. Open the valve slowly and keep the hand on the discharge line; as long as this is warm there is no danger.

To pump out the discharge line N close valves D, A and B and open 1, 2 and 3 and 7 if necessary, then go ahead same as for pumping down the condenser.

To pump out the machine for packing or repairs, proceed as for pumping out the discharge line. Pump about 5 in. vacuum on the line, close valves 1 and 2 and then open valve B a little to let the gas between B and the machine discharge valves which is at suction pressure, since the machine was discharging into the suction line, escape into the discharge line. It is for this reason we pump a vacuum on the discharge line. Now close B and open purge valve 8 to relieve whatever pressure may remain in the machine.

Many machines have an oiling system for the stuffing-box as illustrated in Fig. 2. The oil is fed by gravity from the oil receiver to the oil lantern in the stuffing-box. A gas relief line leads from the top of the stuffing-box to the top of the oil receiver from which a connection is made to the suction line. Consequently there is only suction pressure on the outside half of the stuffing-box packing. In pumping out the machine, always close valves *a* and *b*, otherwise the oil will leak through the last half of the stuffing-box packing from the oil receiver into the machine.

It is a good idea to shut these valves at any time when pumping out, especially when the bypasses are used, because there may be as much as 50 or 60 lb. difference in pressure between the suction line and that in the machine and this may force a large quantity of oil past the last half of the packing into the machine; also, if there is leakage here the pumping down will be much slower.

Figure 3 illustrates the bypass connections for a double, single-acting York machine. By tracing out the connections, it will be seen that the same end is accomplished, as stated before; the action of the machine is reversed. The valves are numbered the same as in Fig. 1 to enable comparisons to be made readily.

According to the United States Geological Survey, it will probably be many years before the interest in briquets will reach a high mark in this country, but it deserves far more attention than it is receiving. More than $1,000,000 worth of briquettes were made out of waste coal dust in 1915, the exact production being 221,537 short tons, valued at $1,035,716. This was the largest output in the United States for any year with the exception of 1914.

Central Station Service in the Manufacture Artificial Ice*

By C. J. Carlsen

In recent publications issued by some manufacturers of refrigerating machinery, elaborate tables were worked up and published, showing the relative fuel cost and power equivalent per ton of ice produced between various types of power equipments with minimum figures of less than 12 cents a ton of ice produced as against purchased energy at nearly 60 cents a ton, and yet the central station interests have done more to advance the use of ice and refrigeration equipment than the combined efforts of the entire selling force of these companies.

Perhaps no better demonstration can be made between power self-produced and power purchased, than by using published figures on plant operation and comparing these with actual costs as operated from central station.

In the October, 1915, issue of Ice and Refrigeration, there appears the following tabulated Plant Account by L. K. Doelling, of New York, to which have been added the necessary data on motor installations and central station operation.

Capacity Every 24 Hours—100 Tons of Ice

Investment	Oil Engine	Steam Engine	Motor Central Station
Oil engines, including rope drive and foundations	$ 25,500		
Exhaust and water piping, oil storage tank, etc.	2,500		
Boiler plant and masonry		$ 5,500	
Steam, exhaust and water piping		2,000	
Steam engine for d-c, including foundations		9,500	
Motors, wiring foundations and drive			$ 6,500
Compressors, condensers and ammonia piping	10,000	10,000	10,000
	$ 38,000	$27,000	$16,500
Freezing system, complete	27,000	27,000	27,000
Ice storage	1,500	1,500	1,500
Buildings	35,000	35,000	35,000
Property	8,000	8,000	8,000
Total	$109,500	$98,500	$88,000

Comparison of Daily and Yearly Cost of Operation Between Oil Engine and Steam-Driven Ice-Making Plants (Electrically Operated Plant Added)

annual load-factor 60 per cent

Daily Operating Expense	Oil Engine	Steam Engine
Chief engineer	$ 6.00	$ 5.00
Assistant engineer	3.50	3.50
Oilers	4.00	4.00
Firemen		4 50
Tank men	8.00	8.00
Storehouse men	4.00	4.00
Other labor		
Fuel—Coal at $3.50 per ton		38.50
Oil at 3½ cents per gallon	15.00	
Ammonia, oil, waste, etc	10.00	10.00
	$50.50	$77.50

*From a paper read before the N. E. L. A., May, 1916.

Total cost of operation per year on basis of four months' full operation, four months' one-half operation, and four months' one-quarter operation, for 216 days (60 per cent load-factor).

	Oil	Steam	Electric
Daily operating expenses during period of full operation	$10,908.00	$16,740.00	$17,928.00
All labor expense for balance of year	3,672.00	4,176.00	Total Production Cost
5% Depreciation on cost of mechanical equipment	3,325.00	2,775.00	2,250.00
3% Depreciation on building	1,050.00	1,050.00	1,050.00
5% on Total investment for repairs, taxes, water and incidentals	5,475.00	4,925.00	3,200.00
	$24,430.00	$29,666.00	$24,428.00
Number of tons produced annually	21,600	21,600	21,600
Total cost per ton of ice per annum	$1.125	$1.40	$1.125

Daily operating expense totals, as given for electrical operation cover a 12-mo. period and include all labor and purchased power, repairs and maintenance, water, oil, waste and incidentals, and these latter items are therefore deducted from the "5 per cent on total investment for repairs, taxes, water and incidentals" leaving a charge of $3200 for this equivalent expense.

In Ice and Refrigeration for December, 1915, we have still another comparison by William T. Price between steam, producer gas, belted and direct-connected oil engines, and again electrical data have been supplied for comparisons.

In every case the only true measure of comparison must be the cost of an equivalent product delivered on the platform and including all items of risk and service, location and supervision, maintenance and amortization, as well as operating, production and investment costs, rather than elaborate tables based on theoretical possibilities and showing highly efficient results along one line of comparison only.

Ignore the prime mover for the moment; put the plant in its highest stage of economical production, which includes labor among other items, and then apply your measures of comparison as outlined above and there will be found no glaring differences in total costs between central station service at 1c per kw.-hr. and any other form of prime mover selected and applied on an equivalent basis.

The preceding comparisons have been made on the basis of one size of plant only—100 tons daily capacity—and the figures used in connection with electrical plant operation are based on the average of several plants. Had the figures for best plant operation been used results would have been considerably more in favor of purchased power, and had the larger plant size been compared even better results would have been obtained.

Fuel cost is another item not to be lost sight of; coal and oil are both increasing in cost, not so much on railroad as on wagon deliveries, yet increasing nevertheless, while with central station service the absolute cost per

unit of power is a known quantity for a definite term, usually 5 yr. or more.

Overload capacity of both service lines and motors is an item worthy of the most careful consideration and can always be depended upon in case of emergency; its only rival is the steam engine, as neither the gas nor the oil engine have any reserve or overhead capacity to speak of.

In the last few years, wherever an ice plant has been installed producing its own power and located in the vicinity of a central station, electric service has usually been installed as an emergency precaution and in some cases used entirely for plant auxiliary service. As auxiliary service is by far the most important power requirement in an ice plant and necessary to its successful operation, this is certainly a high tribute to the value of the service; but if purchased power is good enough for auxiliary service, it certainly should be good enough for the entire plant operation.

Let it again be stated that there is absolutely no intention whatever of deprecating the value and service of the oil and the more modern steam engine equipments; developments along these lines during the past few years have been nothing short of marvelous and, in many cases, results obtained have been all that manufacturers have claimed for them. When it comes to a question of thermal efficiency the oil engine stands far in the lead in its class; but, fortunately for central station interests, thermal efficiency is by no means the all-deciding factor.

The oil engine is, by far, the closest competitor to central station operation in this class of service and it is not to be wondered at that manufacturers are putting forth mighty efforts in the nature of publicity reports, operation, etc., in order to secure this business. In some plant installations, although oil engine drive had been advised and results worked out showing enormous annual savings over any other form of power, yet the appeal of simplicity in operation and equipment of motor-drive and purchased power has been so strong as to overcome the estimated economies of power self-produced. To such as read this paper it may be gratifying to know that they have not made a tremendous mistake after all by electing to use central station service.

INVESTMENT AND OPERATING COST—100-TON ICE PLANTS

Investment	Steam	Producer Gas	Belted Oil Engine	Motor Central Station	High Speed Compressors D-C Oil Engine	High Speed Compressors Motor Belted
Equipment, power end and compressor side	$ 27,000	$ 39,000	$ 38,000	$16,500	$ 34,000	$12,500
Freezing system complete	27,000	27,000	27,000	27,000	27,000	27,000
Ice Storage	1,500	1,500	1,500	1,500	1,500	1,500
Building, including 300 tons ice storage	37,000	35,000	31,000	31,000	29,000	29,000
Property	9,500	10,000	9,100	9,100	8,700	8,700
Total	$102,000	$112,500	$106,600	$85,100	$100,200	$78.700

TOTAL COST PER ANNUM ASSUMING FULL CAPACITY FOUR MONTHS, HALF CAPACITY FOR FOUR MONTHS, AND ONE-QUARTER CAPACITY FOUR MONTHS, EQUIVALENT TO 216 DAYS' FULL CAPACITY (60 PER CENT LOAD-FACTOR)

Steam, coal at $3.50 per ton, 8 to 1	$ 9,450					
Pea anthracite at $4.50 per ton, 26 to 1		$ 3,740				
Fuel, oil at 3½c per gallon, 1 to 4.5 gallon			$ 3,400			
Electrical operation, 1c per kw.-hr				$17,278		$17,278
Direct-connected, unit 1 to 4 gal					$ 3,020	
Ammonia, oil, waste, etc., 6c to 7c per ton, 3c elec	1,300	1,500	1,500	650	1,500	650
Chief engineer	5.00	6.00	6.00		6.00	
Assistant engineer	3.50	3.50	3.50		3.50	
Oiler, 2 shifts	4.00	4.00	4.00		4.00	
Fireman, 2 shifts	4.50	4.00				
Tankmen	8.00	12.00	12.00		12.00	
Storehouse men	4.00	4.00	4.00		4.00	
	$29.00	$33.50	$29.50		$29.50	
Attendance, 365 days	10,600	12,250	10,800		10,800	
Repairs, 3 per cent on total investment	3,060	3,490	3.170	2,000	3,000	1,810
Depreciation on building 3 per cent	1,110	1,050	930	930	870	870
Depreciation on equipment 5 per cent	2,770	3,370	3,320	2,250	3,120	2,050
Total	$28,290	$25,380	$23,120	$23,108	$22,310	$22,658
Number of tons produced annually	21,600	21,600	21,600	21,600	21,600	21,600
Total cost per ton of ice	$1.31	$1.17	$1.07	$1.07	$1.03	$1.05
Annual saving, direct-connected oil engine ice plant	$ 6,000	$ 3,000	$ 810	$ 798		$ 348

THE PRODUCTION of anthracite in 1915, as shown by the final figures compiled by C. E. Lesher, of the United States Geological Survey, from returns made by the operators, was 79,459,876 gross tons, differing from the estimate of 79,100,000 tons published last January by less than one-half of 1 per cent. The value of this output was $184,653,498, an average of $2.32 per ton, a value slightly higher than the average in 1914. Compared with the figures for 1914 those for 1915 show a decrease of 2 per cent in quantity and 1.9 per cent in value.

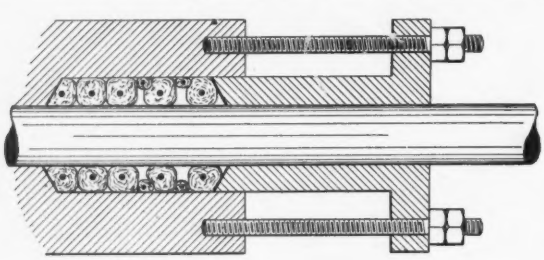
LETTERS DIRECT FROM THE PLANT

Cash Paid For Ideas Accepted. Sketches Desirable.
We Make The Drawings

Packing a Piston Rod

WHEN THE piston rod on one of my high-speed engines is packed in the ordinary way, steam leaks out around the outside of the gland, and not around the rod. By using 5 rings of ¾-in. round packing, and 2 of ⅜-in., putting them in as shown in the illustration, this leak is prevented. Of course, the rings of small packing must be fitted accurately, so that there will not be an open space between the ends, in order to secure good results.

The space for packing in this case is ⅝ in. in diameter, hence the ¾-in. packing is flattened with a hammer until it can be pushed into place by hand. When



UNUSUAL METHOD OF PACKING PISTON ROD

3 rings are in place, the gland is forced in hard until the rings are settled into place, then more are inserted, and the process is repeated. The nuts are then loosened, and screwed back into place by hand only. Steam blows out around the rod at first, but the nuts are screwed down only far enough to stop this leak. After this packing has been used a few days and adjusted accordingly, another ring is put in, thus completely filling the stuffing box.

W. H. WAKEMAN.

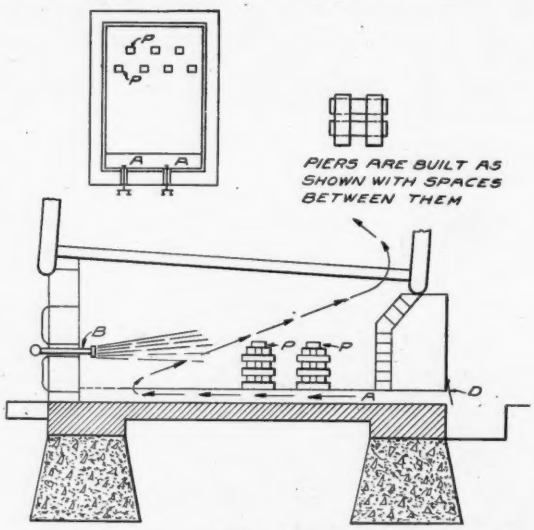
Oil-Burning Furnace

ACCOMPANYING is a sketch of an oil-burning furnace which gives good service here. The flame from burners is directed against 7 brick piers, P, which breaks up the fire and spreads it evenly over the furnace. The fire brick piers also become incandescent and help to burn the gases, giving complete combustion. There are 4 piers across the furnace in the first row and 3 in the second, as shown in the sketch.

The damper, D, is at the rear of the boiler. The air, A, passes under the furnace floor and is preheated before reaching the oil from burners.

The piers last a long time and are easily renewed when they become melted down. Building arches is expensive and takes time, and as this way works so well, perhaps it will be useful to some plants where oil is used for fuel.

A checker work of fire brick is placed on iron bars which reach across the furnace underneath the burners to break up the air before mixing with the flame. The



ARRANGEMENT OF PIERS IN OIL-BURNING FURNACE

piers are built without the use of fire clay and the bricks are not close together, so as to let the flame work in between them.

D. J. WOLLAM.

Steam Engine Cylinder Lubrication

AN 18 by 18-in. Skinner engine operating under a load of about 200 hp. is served by a 4-in. steam line about 500 ft. long. Considerable water in the steam at all times is taken care of in a satisfactory manner during the winter months by means of a large separator, with a suitable trap, situated in the line near the engine. This is due to the fact that a 2-in. line is taken from the 4-in. line at a point about 150 ft. from the engine, this line serving a large number of radiating coils used to heat one of the buildings. The small line helps to drain the water from the steam before it reaches the separator.

Recently, however, we discontinued using the heating system on account of warm weather and closed the 2-in. valve close to the 4-in. line. We immediately had trouble. The separator could not handle the water in the line; the consumption of cylinder oil more than doubled; and it kept the engineer busy to keep the engine from pounding like a trip-hammer. After several days of trouble, as an experiment, we quit using No. 1 cylinder oil on the engine and substituted cylinder stock oil, a heavy, viscous black oil used on heavy, rough bearings in the mill. Our problem was solved. The engine stopped

pounding, the oil consumption came down to normal and we have had no more trouble.

We have figured it out like this: Shutting off the heating system gave us more water in the steam at the separator, slightly more than the separator could handle but not enough to harm the engine; however, the increase in water was enough to wash the film of oil off the cylinder, necessitating constant pumping of oil into the cylinder to keep it from knocking. The use of the heavy, sticky stock oil cured this because the oil was too viscous to be swept off by the steam and water.

Upon opening the cylinder after a run of 2 weeks with the stock oil, we found the cylinder in better shape than it had been found for a long time. It was smooth and thoroughly coated with a sticky film of oil. Indications are that we can cut our oil consumption down on this engine considerably below what we have been using during the past year. The fact that the stock oil is only half as expensive as the regular cylinder oil, is also an interesting point.

Our only difficulty has been that the heavy stock oil tends to clog up the lubricating pump; however, periodical cleaning of the pump solves this difficulty. Another question which can only be solved by time is whether or not the stock oil, probably containing a certain amount of fine impurities, will cut out the cylinder or cause it to wear. From our inspection after 2 weeks' run, we are of the opinion that we will have no trouble, the oil apparently keeping the cylinder walls well lubricated. It is barely possible that the use of the heavier oil may prevent wear by its more efficient lubricating qualities.

J. K. L.

Saving the Drops

J. C. HAWKINS, I notice, replied in an interesting way to my contribution under this title. It seems that he hasn't much confidence in my method of testing the lubricating quality or quantity of an oil by merely taking the time required for the engine to come to a dead stop. Nevertheless, I have had good success with that method, especially with gasoline engines.

No doubt, the lubrication question is even more difficult to solve in gas engines than in steam engines because of the greater heat in the former, and the actual contact of flame with the lubricant. In many cases gas engine cylinders are virtually "flooded in oil" in order to remove the lubrication difficulty, and such pistons actually give satisfactory results.

I have heard engineers remark that they "never have any trouble oiling an engine because they use plenty of oil all the time," and they further claim that they have never heard of an engine that had too much oil. Usually those engineers are right. The only serious objections to too much oil emanate from the pocketbook and from the troubles with oil in the boilers where condensate is reused in the boiler feed.

Again, there are cases on record where steam engines have not been oiled at all, except, perhaps, on starting. It is the opinion of the engineers in charge that after a piston and cylinder are bright and polished the moisture in the steam serves capably as a lubricant, and after several years run they point with pride at the excellent condition of the cylinders that were not lubricated. Now, it is my belief that Mr. Hawkins' method would hardly hold in such a case as that. He wouldn't find even a trace of oil. But the flywheel test would tell pretty accurately whether or not the piston is consuming too much power.

According to one of my books, Robert Thurston determined the following friction distribution in a steam engine:

Main bearings	35–47 per cent
Piston and rod	21–33 " "
Crankpin	5–7 " "
Crosshead and gudgeon pin	4–5 " "
Valve and rod (balanced)	2.5 " "
Valve and rod (unbalanced)	22 " "
Eccentric strap	4–5 " "
Link and eccentric	9 " "

Bearing lubrication has been improved vastly since the time of Thurston, and unbalanced valves are out-of-date, so piston lubrication, in my opinion, is the greatest consumer of power in engines at the present time. That being the case, the stopping time is dependent largely on the effectiveness of cylinder lubrication.

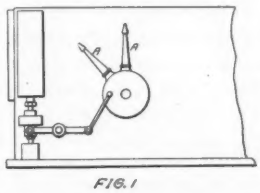
I do not claim that it is unwise to take off the cover and look at the cylinder and piston every once in a while to assure oneself that all is well inside, but I recommend that the stopping time be taken also.

A few months ago (Dec. 15, 1915), I gave a formula in Practical Engineer for "Determining the Cost of Poor Packing." That selfsame formula can be very properly used in determining the cost of poor lubrication, especially if the cylinder is so poorly lubricated that a difference can be noted in the time required for the engine to come to a stop.

N. G. NEAR.

Curing Hot Eccentrics

FROM THE first day the engine took the load, the eccentrics ran hot. The erector explained that, as it was a case of cast iron running on cast iron, when the surfaces had adapted themselves to one another, the finest kind of bearing surface would be obtained; that while the pressure per square inch was low, yet the bearing surfaces were large, hence considerable friction resulted.



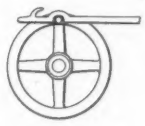


FIG. 1. STARTING BARS USED ON WRISTPLATE
FIG. 2. WRISTPLATE HAVING FLYWHEEL APPEARANCE

After the departure of the erector, the engineer removed the wipers which were provided on the eccentrics and replaced them with the drip troughs, which was a move in the right direction, as it made it possible to receive oil at every part of the revolution.

The engineer became convinced that the cylinder oil was not what it ought to be in quality, and obtained a better grade, which he fed to the cylinder in greater quantity than good lubrication of the cylinder and valves required in an effort to reduce the friction load on the eccentrics. In the meantime, the eccentrics were as hot as ever.

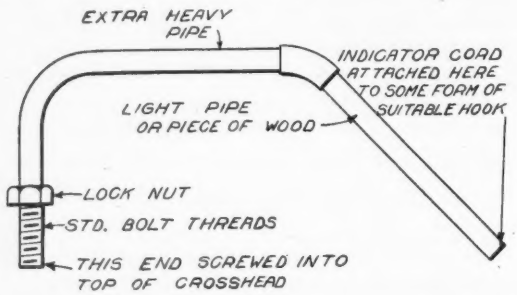
The engineer related all of the above to the writer and suggested that he have a look at the engine in operation. In view of what had been done, I was stumped for a while, then I suggested removing the starting bars, A, A, Fig. 1, from the wristplates, and leaving them out. No change was noticed in the temperature until the middle of the afternoon, when the straps began to cool and have since run as cool as could be desired.

It was formerly the practice of some builders to make the wristplates like a miniature flywheel, as in Fig. 2, all of which made more mass to be started and stopped twice each revolution and caused an additional load on the valve gear.

Thanks to competition and modern design, the builders are cutting down the weight of parts and better running machines result. RECEIVER.

Indicator Cord Attachment

I SECURED a piece of extra heavy ½-in. iron pipe upon one end of which I cut a standard bolt thread so as to allow this pipe to be screwed into a properly tapped hole on top of the crosshead. This I held in place as shown in the accompanying illustration by means of a lock nut. The pipe was then bent so as to be out of the way of all parts of the engine frame when attached to the moving


EXTRA HEAVY PIPE
INDICATOR CORD ATTACHED HERE TO SOME FORM OF SUITABLE HOOK
LIGHT PIPE OR PIECE OF WOOD
LOCK NUT
STD. BOLT THREADS
THIS END SCREWED INTO TOP OF CROSSHEAD

A SIMPLE AND EASILY CONSTRUCTED APPLIANCE TO BE ATTACHED TO CROSSHEAD FOR OPERATION OF INDICATOR MECHANISM

crosshead, and the opposite end threaded and provided with either a 90 or 45-deg. ell as conditions demand. A piece of good tough and straight-grained wood of such a length that its extreme end traveled along the path of the indicator cord, was then screwed into the open end of the ell. The indicator cord was then attached to the end of this wooden arm by some form of suitable hook. B. M. BABCOCK.

Rules for Packing Rods

IN THE issue of April 1, A. D. Palmer quotes some rules regarding the packing of rods, to several of which I take exception.

Rules 1 and 7 are passable without protest. Rule 2 calls for ¼ in. clearance, in cutting packing over ½ in. wide. This is entirely too much, as proven when old packing, so cut, is removed and found to have a lump in the side of each ring, where it entered the open slot in its neighbor.

Rule 3 should read, "Clean out all old packing, if possible by blowing out with steam, first having removed the gland." Given steam to do our work for us, why waste time prying the stuff out in little morsels?

Rule 4 says, "Set up each ring with the gland, until the packing bottoms in the box." This is only possible with a very long gland. Further, "Fill the box until it is within 1 thickness of being filled, then insert gland." This should be left to the intelligence of the man in charge of the work, as in many cases the rule quoted would be quite wrong. Given space of 1¼ in., a 1-in. packing, and only 4 rings already in, another is clearly needed.

Rule 5 begins well, but goes astray sadly in saying, "It is advisable to let steam blow by packing for the first 24 hr." This would be the destruction of any packing. Blowing steam tears and cuts packing to rags.

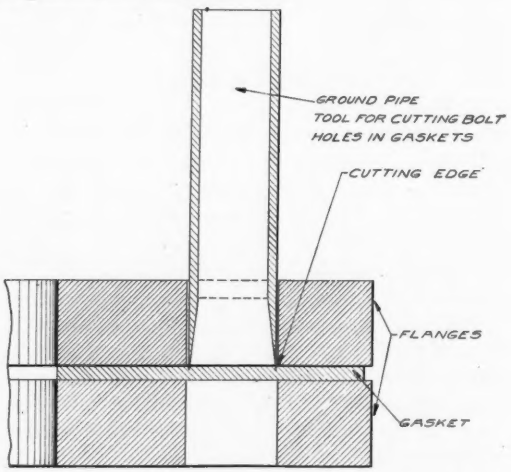
Rule 6 is applicable only in cases where good design and light load combine to make an easily run box.

Rule 8 calls for an adjustment to the easiest running position. The rule seems absurd, as this would mean taking the gland off altogether. H. K. SCHOLEFELD.

Cutting Bolt Holes in Gaskets

ON THE construction work involved in some recent additions to our plant capacity it was necessary to make all possible haste, and hence special attention was paid to cutting down time consumption wherever possible.

It was noted that the fitters employed by the piping contractor were wasting much time in cutting, fitting and punching the gaskets in the pipe lines, using the old round head hammer method for knocking the bolt holes in the gaskets, for instance.



METHOD OF CUTTING BOLT HOLES IN GASKETS

We speeded them up on this work by having them order a large quantity of blank gaskets of the 4, 6 and 8 in. sizes which were used on the job.

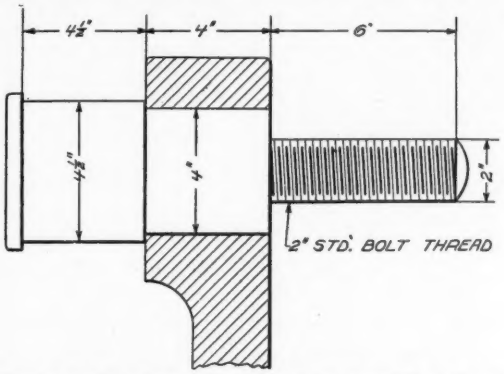
To punch the bolt holes in the gaskets, we made cutting tools out of ¾-in. steel pipe, grinding the one end down to a cutting edge. After the gasket was inserted between the flanges, the cutting tool was used to pierce through the gasket at each bolt hole. This procedure not only did away with the tedious job of knocking the holes in the gasket with the round headed hammers, but it further facilitated the work because the gaskets could be inserted into the flange joint without the necessity for bringing the bolt holes to match.

M. SALLER.

Replacing a Crankpin

THE ACCOMPANYING sketch shows a simple method of replacing a crankpin which was used on a 250-hp. cross-compound steam-driven air compressor.

The original pin worked loose after the engine had been running about one year, and it was necessary to get the engine in service again as quickly as possible. We had no jacks for this class of work, and there was very little space to get at it without lifting the crank-



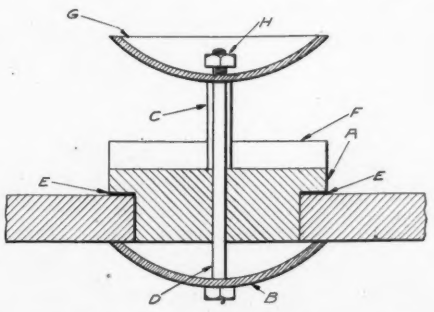
CRANKPIN WITH EXTENDED, THREADED PORTION FOR DRAWING INTO PLACE

shaft and flywheel. I decided that the quickest and cheapest method was to make the crankpin 6 in. longer than required, and thread the end for a 2-in. standard nut, as shown in the sketch, using this to draw the pin in place. The end was cut off with a hack saw after the pin was pulled up tight.

This repair was made about 4 yr. ago, and the engine has run without any further trouble up to the present date. A. H.

Novel Pump Valve Seat

IN WATER PUMPS, where brass valve seats are screwed in the iron casting, trouble may be experienced with the threads stripping or corroding, and the whole seat comes off and rattles in the chamber. Often we attempt to put it back into place again, providing a shadow of



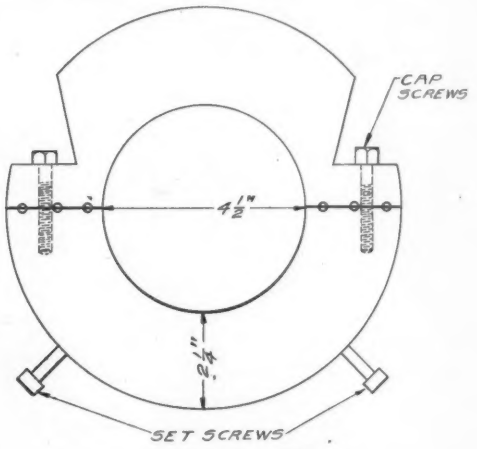
PUMP VALVE SEAT WITHOUT THREADS

some thread still remains. And we screw it back with care, hoping it will stay put; but usually, after several days or weeks, the blamed valve comes off again. We thought out a solution to this problem, as shown in the illustration. We do away with threads altogether.

A shows the shoulder on the seat. B is a yoke. C is a pipe nipple fitting as a sleeve over the bolt D. E is sheet packing. F rubber valve. G brass protector for the rubber valve. H is the nut which, when tightened reasonably, holds the whole affair snugly where it belongs without giving further trouble. M. L.

Making a Split Set Collar

WHILE REPLACING a 4½-in. broken crank shaft by a new one on a stone saw, after the crank disk, belt pulley and flywheel were in place and keys driven in and shaft lowered into the bearings, I discovered that I had overlooked placing the set collar on the shaft. As it would have been much work to remove the flywheel and belt



SPLIT SET COLLAR

pulley from the shaft again, and the saw was needed badly, and as no split collar of this size could be obtained immediately, I decided to make a quick repair by making a split collar out of the old solid collar, which was done in the following way:

A number of holes were drilled sidewise into the collar which was then broken. Then notches were cut into the half of the collar where the heads of the 2 cap screws could rest as shown in the illustration. This split collar was made before other parts of the saw were ready to run. H. A. JAHNKE.

Correction Note

IN THE article entitled "Clean Blades for Turbines," by W. E. Smith, on page 493, of the June 1 issue, our attention is called to a typographical error which appears in the fourth line of the second column. It is stated there, "Use 1 gal. of oil twice a day per 100 kw. capacity." This should be 1000 kw. capacity.

IN COMMERCE REPORTS of the Bureau of Foreign and Domestic Commerce are listed the following opportunities for foreign trade in power plant material: Iron piping for aqueducts in Colombia; wiring and insulating material, electric fixtures and incandescent lamps for insular trade, oil engines of 4-cycle horizontal type for India. Full details may be had from the Bureau, Washington, D. C.

Questions Answered and For Answer

Expert Help When In Trouble. If You Want Quick Answer Enclose a Stamp

Placing Old Generator in Operation

I HAVE a 2-pole compound-wound direct-current generator which has not been used for some years. All leads are disconnected, but in all other respects the machine appears to be in good condition. How would I go about to reconnect it properly? How can I find the polarity of the pole pieces? Would any harm result in sending current through the field windings in the wrong direction? W. G. S.

A. It will be desirable to test up your machine somewhat before trying to operate it, to make sure that there are no defects in the windings. If you have 110-v. lighting current available, we would suggest, first, that you connect up leads to this circuit, putting in a double-pole knife switch and fuse, and arranging to use a voltmeter and low-reading ammeter.

First, test out the shunt circuit by putting the ammeter in series and sending current through the shunt fields, to make sure that the circuit is not open at any point. It will be well, also, to test the voltage drop over each field coil with a voltmeter, to make sure that there is the same drop over each, and that there is no short circuit in the field windings.

Next, put a water rheostat in circuit and test up the series field in the same way, regulating the water rheostat so that about 10 amp. will flow through the windings.

While making this test, try the polarity of the pole pieces with a pocket compass. Do not bring this too near, so that the pole pieces will not change the magnetism of the compass needle. The shunt and series coils should be so connected that they will work together—that is, both of them will give the same pole pieces, north and south. Then, in connecting up, be sure that corresponding ends of the 2 coils are connected to the same brush of the machine.

An armature test is not necessary before starting the machine, as any defects will show in operation, and if there is trouble, this can be tested up later. The connections of the leads should be from one brush lead to the end of a series coil and to the corresponding end of the shunt winding. Connect the other end of the series winding to the line, also the other brush; connect the other end of the shunt winding through a rheostat, to the second brush.

Of course, there should be a main switch between the generator and the line, and preferably a field switch between the rheostat and brush. If the machine is to be operated in parallel with any other compound dynamo, there should be an equalizer connection put in between the brushes which connect to the series coils; but the attempt to operate in parallel should not be made until the electrical polarity of the machine you are testing out has been determined, to make sure that you are connecting positive brush to positive brush.

If no current is available, test the present polarity of the pole pieces with a pocket compass to make sure which is the north and which the south pole. Connect up the series winding and the armature and leave the shunt winding disconnected and throw on a water rheostat load. Drive the machine and watch the voltage at the brushes. This will involve the use of a low-reading voltmeter. If the voltage increases as the load comes on, the series coils are working in the right direction—that is, to help out the residual magnetism in the pole pieces; if not, the series connection should be reversed.

Next, disconnect the series coil, connect in the shunt, and again use a water rheostat load. Bring the machine up to speed slowly and watch the voltage at the brushes. This should build up as the machine speeds up. If it does not, reverse the shunt field connections and try again.

When you have determined the brush to connect the series and shunt field leads, be sure that the connection is made up as outlined above, for the first method, so that the shunt and series coils will operate together to build up the voltage of the machine.

After connections are made, it is best to try out the machine with a water rheostat load to see that there is no flashing or sparking on the commutator, which might indicate an open circuit or a short circuit in an armature coil. The short circuit will be indicated by heating of the armature coil at some point, while the open circuit will be indicated by a vicious flash as the bars to which the open coil is connected pass under the brushes. A.L.R.

Electrical Problems; Condenser Question

A CURRENT of 10 amp. flows for 1 hr. through a resistance of 50 ohms. Calculate the work done in joules. What is the rate in horsepower at which the work is done?

2. A group of 3 circuits in multiple is connected across the line wires of a 100-v. circuit. The first circuit has a resistance of 10 ohms, the second a resistance of 25 ohms, and the third a resistance of 50 ohms. (a) What is the joint resistance of the 3 paths in multiple? (b) What is the current in each circuit? (c) What is the rate in watts at which work is being done in each of the circuits?

3. Why is it necessary to have the lower end of the discharge pipe of a siphon condenser immersed in the water of the hot well? T. F. McN.

ANSWERS

THE NUMBER of joules may be obtained by multiplying the number of amperes squared times the resistance in ohms times the number of seconds in an hour. Substituting the values given we have, 10 times 10 times 50 times 3600 or 18,000,000 joules.

To reduce this to horsepower equivalent, divide 18,000,000 by the product of 3600 times 746; this gives us 6.7 hp.

A watt is one joule second, so by dividing total joules by the number of seconds gives the watts. Then, to change watts to horsepower, divide by 746.

2. (a) The combined resistance of the 3 resistances connected in multiple across the 100-v. circuit may be obtained by dividing 1 by the sum of the reciprocal of the first plus the reciprocal of the second plus the reciprocal of the third. Or, substituting the values given, we have 1 divided by the sum of 1/10 plus 1/25 plus 1/50 or 6.2 ohms.

(b) The current in the 10-ohm circuit will be equal to 100 divided by 10 or 10 amp.; in the 25-ohm circuit, 100 divided by 25 or 4 amp.; in the 50-ohm circuit, 100 divided by 50 or 2 amp. The value of the total circuit flow will then be equal to 10 plus 4 plus 2, or 16 amp.

(c) The work done in the 10-ohm circuit is equal to 10 times 100, or 1000 w.; in the 25-ohm circuit, 4 times 100, or 400 w.; and in the 50-ohm circuit 2 times 100, or 200 w.

3. In a barometric condenser, the lower end of the discharge pipe is immersed in the water of the hot well to prevent air entering the pipe and breaking the vacuum. W. P.

Examination Questions and Answers for New York City Electrician's License*

SHOW HOW to connect a 3-way switch for 2 points of control.

A. See diagram.

24. How are boxes fastened to concrete ceilings before the concrete is poured?

A. Fasten to the concrete forms.

25. What are the maximum number of watts and number of volts allowable in metal molding?

A. 1320 w.—300 v.

26. Why is it necessary to place both wires of an alternating-current circuit in a single conduit?

A. This is done to prevent the effects of inductive action. By the use of 2 adjacent conduits, each carrying a single wire of the circuit, transformer action will be established resulting in a shocking effect with an attendant drop in voltage and heating.

27. How is a combination fixture attached to a combination outlet composed of an iron box on a metal ceiling?

A. By means of a combination insulating joint. Canopies of fixtures must be insulated from ceiling.

28. How would a switch box without any gas pipe entering, be fastened to the wall?

A. Without gas pipe being available to which to secure the box, mount a 7/8-in. board on the building lath and attach the box to this. If this cannot be done, use a standard built up of pipe and pipe fittings.

*Continued from page 545, June 15 issue.

29. What will happen if the neutral fuse of a 3-wire system blows?

A. The load will tend to divide and if the system is well balanced no difference will be noticed. If, however, the lighting load is unbalanced, the lamps on one side will burn brighter than those on the other.

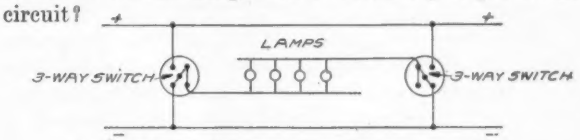
30. Under what conditions is a running thread required and how long must it be?

A. A running thread is required where the conduit to be joined cannot be bent or shifted any great amount. The end of one of the lengths of conduit is provided with a thread of such length that it can carry a coupling and 2 locknuts, one on either side of the coupling. The conduit may then be put in place and the lock nuts and coupling run onto the conduit to be joined in a secure manner. Such connections may also be made by means of a special non-steam tight union.

31. What protection is required on knob and cleat work?

A. Wires must be properly separated and protected from mechanical injury; where brought into close proximity with other wires they must be covered with flexible tubing and where passing walls or ceilings approved (porcelain or conduit) tubing used.

32. With but one circuit available, how would you connect 7 60-watt lamps and a 750-watt glue pot to the circuit?



CONNECTION DIAGRAM OF A 3-WAY SWITCH

A. Use the circuit for the lamps and connect the glue pot to feeders by means of fuses.

33. What is an induction alternator?

A. This is a synchronous alternator in which both field and armature windings are stationary and in which masses of iron or inductors by moving past the coils, after the magnetic flux through them. It may be either single-phase or polyphase.

34. How would you connect 75 40-watt lamps on a 3-wire Edison system?

A. On 5, or preferably 6 circuits mounting fuses for each circuit, and balancing them as well as possible.

35. What precautions would you take in removing fuses carrying current?

A. When not permitted to cut off current, use jumpers around the fuses.

36. Define the watt.

A. The watt is the electric unit of power represented by the flow of 1 amp. of current under a pressure of 1 volt.

37. How many small motors may be placed on a single circuit?

A. No more than require a combination maximum consumption of 660 watts.

38. What is the purpose of a bushing?

A. To support wires and serve as not only a mechanical protection, but also as an insulator.

39. What kind of socket is required where the air is laden with fine particles of sawdust? Why?

A. Dust, steam and water-proof globes should be here used to prevent possibility of fire.

Problems For Discussion By Readers

What Would You Do If You Had These Conditions To Meet?

What Amount of CO_2 Do You Advise?

IN BURNING West Virginia natural gas having a heat content of, say, 900 B.t.u. per cubic foot, how many cubic feet are required to develop one horsepower?

When burning such a gas under a boiler, what per cent of CO_2 will give the best efficiency? The same as coal?

What percentages of CO_2 are required for efficient boiler operation when firing with oil, gas, hard coal, wood, lignite, etc.?

For making CO_2 determinations, in the case of a horizontal water-tube boiler, should the samples be taken from the first, second or third pass? C. W.

U. S. Civil Service Examination Questions

SOME TIME AGO, the writer took an examination for First Class Steam Engineer under the U. S. Civil Service Commission for positions in government buildings. The nature of the questions asked may be of interest to some of Practical Engineer's readers. It is not permissible to copy questions, and the following are as I remember them. I would be pleased to have the questions discussed in this magazine. The time allowed was 8 hr.

Write a letter of about 150 words to the Civil Service Commission on one only, of the following subjects:

(A) The advantages of direct and indirect lighting.

(B) An account of some boiler explosion which you have witnessed.

1. (a) How are the tube holes formed in boiler heads? (b) What precautions should be taken in calking seams? (c) How are rivet holes formed? (d) What material is used for boiler heads? Rivets? Manhole plates? Stays?

2. (a) What is the difference in construction and arrangement of grates for anthracite and bituminous coal? Explain your reason for this answer. (b) Describe and sketch the arrangement of the furnace (including nozzles) for burning crude oil.

3. Describe the down draft furnace, and draw a sketch of a cross section showing the connections to the boiler.

4. A boiler having 640 sq. ft. of heating surface evaporated 2450 lb. of water from a temperature of 80 deg. F. (heat of liquid 48.04) into steam at 95 lb. absolute pressure (heat of liquid 294.1 and heat of vaporization 890.9) per hour. (a) What is the equivalent evaporation per hour from and at 212 deg. F.? (b) What is the equivalent evaporation per hour per square foot of heating surface? (c) What horsepower did the boiler develop?

5. (a) Draw an indicator diagram of the high and low-pressure cylinders of a compound engine, designate on the high-pressure diagram what takes place in the cylinder, and name the various lines and points. (b) Combine the 2 diagrams showing the action if the engine took steam into one cylinder at the initial pressure, and exhausted it at the terminal pressure in the low-pressure cylinder.

6. (a) Describe surface and jet condensers as to construction and operation. (b) What is the use of a vacuum augmenter? On what principle does it operate, and under what conditions is it desirable to use an augmenter? Where is it placed?

7. Describe the construction and operation of a Curtis or Parsons turbine. How does its economy compare with a reciprocating steam engine? Give reasons for your answer.

8. (a) Draw a diagram of a Corliss engine cylinder, showing the location of the valves, and explain their method of operation. (b) What are the advantages of 2 eccentrics and 2 wristplates on a Corliss engine? (c) What are the advantages of the Corliss engine over other types.

9. (a) In synchronizing an alternator before putting it on the busbars of a power station, what means does the switchboard man employ to control the speed? Explain fully. (b) Should the incoming generator be thrown in on the increasing or decreasing speed? Give reason for your answer.

10. (a) When starting elevators with full magnetic control, state how the switches are closed, and what causes this action. (b) State how these switches are arranged to close in sequence rather than simultaneously.

11. How would you place the stop-check valve in a line between a boiler and header? Show by a sketch the manner in which it should be arranged?

12. Give 2 methods of starting polyphase induction motors.

13. (a) In a commercial 3-phase, 60-cycle, 2300-v., 20-hp., synchronous motor running at a speed of 450 r.p.m., how many pole fields should there be? (b) State what governs the direction of rotation of a 3-phase synchronous motor. Can its direction be reversed; if so, how?

14. Describe 3 ways of obtaining the neutral of a 3-wire Edison direct-current system.

15. What wear would you expect to find in a Curtis turbine which had been in operation 4 yr. and was just now being taken down for repairs? Describe how this wear would be found, and what repairs you would expect to make. How would these repairs be made?

16. (a) Is a constant current (tub) transformer started with the secondaries short circuited? If not, how is it started? (b) When several circuits of series lamps are connected to a transformer, and one circuit is to be put out, is the switch at the transformer opened or short circuited? Why? (c) What is the maximum voltage you would expect to find on a constant-current transformer secondary?

17. (a) Sketch a typical week-day load curve on a commercial electric light and power plant for a city of 30,000 to 100,000 population, showing the peaks and valleys. (b) Calculate the load factor of the above plant and state how you arrive at these figures.

J. C. HAWKINS.

Size of Safety Valve

IN ANSWER TO "Some Massachusetts Examination Questions," April 15 issue, page 389, to answer 9 I would add this: The state law of Massachusetts requires that when boiler pressure is reduced 15 lb., the size of the safety valves should be increased. This is due to the fact that lower pressure steam occupies larger space and therefore the valve would be too small. Of course, the valve would lift properly, but the pressure would continue rising until it would reach a point when the valve discharging capacity would be sufficient to take care of the excess of pressure. But, will this pressure be safe?

M. STROSK.

Diagram for Criticism

IN ANSWERING Indicator, I want to say that, if the steam is allowed to enter the crank end of the cylinder somewhat sooner so as to equalize the diagram, and the eccentric is shifted back until the sharp toes of the release ends of the diagram are more rounded, it will improve the diagram and also increase the power of the engine considerably. By shifting the eccentric back, all the events in the diagram shown will occur later, as they should, for they are too early for good economy.

It also seems to me that the throttle valve is not open far enough, or that the steam pipe is restricted or too small.

WM. SCHLIEMANN.

Trouble with Air Compressor Packing

D. C. H. ASKS FOR information in regard to rod packing on his air compressor, stating that the steam blows out on the top of the rod. I had a similar trouble on a single stage Ingersoll-Rand compressor, with crosshead between the steam and air cylinders.

The trouble in this case was due to the babbited crosshead shoes wearing down, and which permitted considerable vertical motion of the crosshead as the crank passed the centers. This had a tendency to wear the packing oblong, and consequently it would leak above and below the rod. Rebabbiting the crosshead shoes (they were not adjustable) cured the trouble.

In the compressor in question, I judge that there is no crosshead between the cylinders, as he states that there is barely room to repack the glands, and it may be possible that the pistons or crosshead are low, or possibly a shoulder worn in the cylinder at each end causes a vertical motion of the rod, thus wearing the packing out of shape. Another cause for this trouble may be that, as there is little room between the glands, it is difficult to repack them properly, and much more difficult to remove all of the old dry packing. In this condition, it would be necessary to draw up excessively on the gland to prevent leakage.

I have experienced far more trouble in packing the air rod than the steam rods. A great many different kinds of packings were tried, but the majority of them would either become hard and score the rod, and be difficult to remove, or else they would soon be cut up and would blow out of the stuffing-box. About the best results were obtained from a packing made up of diagonally split rings with a solid ring between, the idea being to have the packing tight only on the compression stroke, or ½ the time. I found, however, that after running a short time the gland would work loose, due to its constantly pounding the packing. The cause of this pounding was that it had to be left loose or the object of using this style of packing was defeated. This pounding would in a short time wear the packing out, and it would leak. To stop this trouble the gland was removed and new packing put in. The gland was drawn up fairly tight, just enough to prevent leakage, and the distance between the back of the gland and cylinder measured. Then a piece of ¾-in. pipe was cut just long enough to fill this space, slipped over the studs and the gland drawn up tight against them. This kept the gland from pounding the packing, and caused the air to pack the rod from the inside and thus prevent leakage. When the rod began to leak, due to natural wear, the gland was removed and shorter nipples used. No further trouble from this source was experienced, and when the packing was worn out it was in pieces, and easily removed. An oil cup should be placed above each gland on the air rod especially, and a small amount of oil used to lubricate the packing and prevent it from sticking. Air, unlike steam, is dry, and unless the rod is lubricated the packing will heat and stick to the rod or become so hard that the rod will be ruined in a short time.

J. C. HAWKINS.

RESULTS OF experiments upon the effects of atmospheres deficient in oxygen conducted by the Bureau of Mines show that atmospheres that are deficient in oxygen begin to affect men when the percentage of oxygen is about as low as that affecting canaries and mice. Canaries are slightly more susceptible to "oxygen want" than are mice. In mixtures of air and nitrogen containing about 7.6 to 7.8 per cent oxygen, canaries show pronounced distress. When the oxygen content is about 7 per cent, mice show considerable distress, and a man is in grave danger of dying; hence canaries and mice should not be used by exploring parties in mines to show when men unequipped with breathing helmets should retreat, because the atmosphere is low in oxygen.

Mice and canaries, especially the latter, are chiefly of value for indicating to exploring parties the presence of dangerous proportions of carbon monoxide. In an atmosphere in which oil-fed lamps will not burn, an exploring party should not depend upon canaries for further guidance, but should use breathing apparatus in advancing into the atmosphere.

PRACTICAL
ENGINEER
Trade-mark, Reg. U. S. Pat. Off.

PUBLISHED THE FIRST AND FIFTEENTH OF EACH MONTH
BY THE TECHNICAL PUBLISHING CO.
537 South Dearborn Street,
CHICAGO, ILL.

New York Office, 150 Nassau St.

Notify us at once of any change of address, giving the old and the new address, so that your paper may always reach you promptly.

Copyright, 1916, by Technical Publishing Co.
Entered as second class matter May 1, 1908, at the Post Office at Chicago, Illinois, under the act of March 3, 1879.

Circulation of this issue, 22,500.

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Vocational Training and the Power Plant

Bills are now before Congress to assist vocational training, with the intent to make it national in scope instead of leaving it to chance activity of states, cities or private organizations. The sum of three million dollars is proposed as an appropriation to carry on the work, the guidance to be by a Federal Board similar to the Federal Trade and Federal Reserve plans.

Since only 20 per cent of those who attend elementary schools secure high school advantages, and only 10 per cent of those attending high school go on to further courses in colleges or technical schools, it is obvious that to raise further the effectivenesss of the great number who are engaged in our industries, some form of education must be provided which meets the needs of those who go to work on leaving elementary or high schools. Means now available to a limited degree are the Continuation Schools for part time day attendance of youths from 14 to 18 yr. of age, the rest of the day being spent in industry, Evening Schools for personal attendance available to all workers fortunate enough to be near them, and University Extension Courses carried on by lectures where a sufficient number of students are gathered to warrant the expense of traveling instructors, and by correspondence study for individual workers.

All these methods are producing good results where wisely administered, but are dependent on local interest and enterprise, and reach comparatively few of the total number of those engaged in the industries. The purpose of the present bills should be not only to provide for all young men and women up to the age of 16 or possibly 18 yr., not only facilities for training in their chosen callings, but to specify a definite amount of time during the day to be regularly devoted to such training. This is necessary in order to give wider knowledge of principles underlying the industry in which the workers are to do their life work, but to increase mental alertness and increase facility and intelligence of performance.

Compulsory attendance is necessary to secure any adequate results, but the school work should be of such vital interest that the student will be eager to accept the opportunity offered, the compulsory feature being to safeguard against interference by others.

Most power plant workers realize their need of thorough grounding in the science and art of heat utilization and energy transformation. Some early determine definitely that it is a field worthy of the endeavor of a lifetime, and set about proper preparation. Some come into the field later in life, and seek to fill the gaps in their knowledge of the subject by reading and evening work. To all, the vocational school program, properly carried out would give the assistance needed to secure results in the most effective way.

The success of such training in European countries leaves no doubt as to its value to the individual, the industry and the community; and evidently all industries, and the workers in them should be given the benefits of such training, but the training will naturally be adapted in each locality to the industries chiefly represented there. As power plants are everywhere, evidently it behooves the power plant workers to see that satisfactory instruction for their needs is given in all localities.

But an important requisite for success, as shown by H. E. Miles in the American School Journal for May, is that the vocational instruction be fitted to the real needs of the workers as known by those engaged in the practical everyday work, not imposed by a Board which has a good knowledge of education in general, but does not grasp the detail of each industry. This requirement can best be met by an Advisory Board, representing each industry, possibly having also local auxiliary boards for different districts, the duty of such boards being to furnish facts as to the needs of the different industries and districts so as to give a definite, practical trend to the vocational work. The plan has been followed abroad with the best of success, and has been used in this country to a limited degree in connection with evening trade schools. The advisory boards need not be in permanent session, but can meet as need may be found, or when called upon by the Federal Board, and provision should be made, as a definite part of the vocational training program, to pay for expenses and for actual service rendered.

It is to the interest of power plant workers to see that the bill makes provisions for the advisory boards, for their expense, and that when the bill is put into effect, a satisfactory advisory board on power plant training is appointed. The Chamber of Commerce of the U. S. A., the National Association of Manufacturers and the American Federation of Labor are agreed in insisting on such provisions being made part of the bill, and it is in the interest of each of us to lend our influence to that end. Vocational training is for the benefit of the millions of workers who make possible our industries; it will add to their interest in their work, to their effectiveness as citizens, and to the standing of our country among the nations of the world. It is for workers in the power plant field to do their part in securing these benefits, then to see that their industry gets its proper share of the results.

Editorial Comments

To realize the important part played by power plants in our modern domestic life, it is only necessary to take note of the services performed by the power plant in a hotel. Here we find concentrated under one roof people enough to make a small city, they are fastidious in many respects, impatient with services that make demands upon their time and require comfortable, sanitary quarters at all times. The isolated power plant, properly equipped, brings the entire services of the hotel directly under the control of the management and in nearly all cases is considered one of the necessary departments. The new Y. M. C. A. hotel in Chicago is not a stricly commercial enterprise, but it is run on an economical basis and the description of the power plant published in this issue tells what services are performed and the machinery installed to do the work. The economy secured in this plant will be watched with interest and our readers are promised a report as soon as the plant gets down to a working basis.

In the average boiler plant a source of considerable waste which is seldom even estimated is that due to blowing off. There is also considerable danger attached to this operation, and to acquaint our readers with the best approved blowoff valves and piping, we publish the article entitled Blowoff Valves and Systems, believing that a study of this subject by engineers in charge will result in improved conditions in many plants.

To secure highest efficiency from a boiler the heating surface must be kept clean; there is no question about that. Judging from actual conditions, there seems to be some difference of opinion in regard to the relative value of the hand operated steam pipe and the mechanical soot blower. Mr. Trautschold is on the side of the mechanical soot blower and tells us why in this issue—some very good reasons.

Some characteristics of alternating current electricity are exceedingly puzzling to one who attempts to deal with alternating current as he would with direct current. For instance, if you should short circuit an alternator for the first time you undoubtedly will be surprised that the armature does not burn out. Mr. Hague in this issue explains just what happens and why the machine escaped destruction.

Other articles in the Electrical Department are of interest particularly to the men in charge of electrical machinery as they point to solutions of difficulties encountered during operation.

Mr. Kimball tells in story form what difficulties the operator of a water turbine may meet, but more important, how these troubles were overcome.

Never had to pump out your ammonia system? Well, maybe you have, but did you do it without wasting any ammonia and in the quickest and easiest way? Just read the directions given by Mr. Thurston, they are complete yet concise, and every engineer in charge of an ammonia system should know them. It would be a good idea to post these, modified to suit your plant, on a board in the engine room.

Within recent years a number of motor driven ice plants have been installed, and it is now possible to study and compare the cost of ice making in plants driven by oil engines, steam engines and motors. Such a comparison was made by C. J. Carlsen for the N. E. L. A., and we publish an abstract of his paper read before that association.

Among the letters from engineers, your particular attention is called to the oil-burning furnace described by Mr. Wollam, also the letters on cylinder lubrication by J. K. L. and N. G. Near. These are important subjects and are worthy of study. Other letters in this issue are direct helps which will appeal to all who have power plant troubles.

Connecting and starting up an old generator is not a difficult job, that is, if you have done it several times before, and even then you may overlook some of the points brought out in the Questions and Answers department. There are also solutions to some interesting electrical problems and examination questions answered that may prove valuable when you are next called before the examining board.

Some interesting problems are presented in this issue for discussion, and if you have had personal experience along these lines other readers will be helped if you relate them for us.

Among the new and recently improved apparatus we describe a damper regulator, a feed water heater and a gas engine economizer all of which have merits worthy of note.

Illinois Engineers in Convention

TWELFTH ANNUAL MEETING HELD AT HOTEL JEFFERSON, PEORIA, JUNE 7, 8 AND 9

DESPITE the wet and cold weather which prevailed throughout the entire period and as a consequence required the cancellation of some of the numbers on the entertainment program, the Twelfth Annual Convention of the Illinois Engineers proved to be one of the most successful ever held in that state.

While the morning of Wednesday, June 7, was primarily devoted to the registration of delegates, it also afforded the exhibitors ample opportunity to place their exhibits in readiness for the formal opening of the Exhibit Hall that evening.

Sharply at 2:30 o'clock in the afternoon, the convention was called to order in the Exhibit Hall by R. J. Mahood, Chairman of the Convention Committee. After an invocation by the Rev. Dr. Carpenter and the Address of Welcome by Mayor E. N. Woodruff, with response by H. Misostow, President Illinois State Association, C. W. Dull, of the local Association of Commerce, gave a brief address in which he dwelt upon the important position occupied by the engineer in his community and also extended to the delegates all of the facilities which the organization he represented had at hand.

C. W. Naylor, of Chicago, responded to the address of Mr. Dull and in the course of his talk outlined the development of steam engineering within the past 50 yr.

Following the introduction of State President Misostow, the convention was declared officially open.

The evening was devoted to the formal opening of the Exhibit Hall at which time the delegates and visiting engineers were addressed by C. H. Fiske, President, C. S. E. A.; H. Mistele, National Trustee, and J. W. Lane, J. G. Beckerleg and J. F. McGrath, Past National Presidents, and entertained with songs and monologues by various members of the C. S. E. A. Following this program, the majority of those present remained to inspect the exhibits.

The first business session of the convention was held at 9:30 o'clock the morning of Thursday, June 8, and was taken up with the reports of the various committees, communications, notices and addresses by J. F. McGrath and C. W. Naylor on the educational activities of the N. A. S. E.

Continued rain prevented the baseball game scheduled to be played that afternoon between the Engineers and Exhibitors.

Though a trifle chilly, the evening was without rain and all deserted the Exhibit Hall to enjoy a 2-hr. ride up the Illinois River on the Steamer Verne Swain.

While the business session held the morning of Friday, June 9, was the last, it was also the most important of the convention. Reports of the Credential, Auditing, Ways and Means and Constitutional Committees were heard and acted upon, and from the reports of the first mentioned committee, it was found that the total number of delegates in attendance was 44.

Action was also taken by the delegates directing that hereafter all available funds lying idle in the hands of the treasurer be invested in some first-class bond bearing a fair interest return and having ready marketability in case desired or required to turn it into cash.

DELEGATES, EXHIBITORS AND VISITORS ATTENDING TWELFTH ANNUAL CONVENTION OF ILLINOIS STATE ASSOCIATION

Following the selection of Moline as the convention city for 1917, the election of officers took place. This resulted as follows: C. Scott, Alton, President; R. J. Mahood, Peoria, Vice-President; G. Anderson, Chicago, Secretary and Treasurer; W. E. Hill, Moline, was elected to succeed himself as State Deputy.

After the installation of officers, conducted by J. G. Beckerleg with the assistance of F. W. Raven, the convention was declared adjourned.

THE EXHIBITS

DURING the 3 days of the convention the Gold Room of the Jefferson Hotel was converted into an Exhibit Hall where the wares of the exhibitors, all members of the C. S. E. A., were upon display. All of the exhibits were tastefully arranged along the 4 walls of the hall with an additional section occupying the center. Among the exhibitors were: Albany Lubricating Co., New York City; V. D. Anderson Co., Cleveland, O.; Crandall Packing Co., Palmyra, N. Y.; Dearborn Chemical Co., Chicago; H. M. Detrich Co., Chicago; Edward Valve &

Manufacturing Co., Chicago; Garlock Packing Co., Palmyra, N. Y.; Hawkeye Compound Co., Chicago; Hill Publishing Co., New York City; Jenkins Bros., New York City; H. W. Johns-Manville Co., New York City; Keystone Lubricating Co., Philadelphia; Kinsey & Mahler Co., Peoria; Paul H. Krez Co., Chicago; Lunkenheimer Co., Cincinnati; F. Meyer & Bro. Co., Peoria; National Engineer, Chicago; National Refining Co., Peoria; The Peerless Rubber Mfg. Co., New York City; The Wm. Powell Co., Cincinnati; Practical Engineer, Chicago; R. H. Rawson, Chicago; Republic Flow Meters Co., Chicago; Sangamo Electric Co., Springfield, Ill.; Schaeffer & Budenberg Manufacturing Co., Brooklyn, N. Y.; G. L. Simonds Co., Chicago; Southern Engineer, Atlanta, Ga.; Standard Oil Co., Whiting, Ind.; Thayer & Lynn, Chicago.

What Are Yonkers?

IT ARE OR IS THE CITY WHERE NEW YORK ASSOCIATION OF ENGINEERS MET IN CONVENTION, JUNE 8 TO 10

AND it was a good convention and a good display of power plant methods and accessories. Not many makers of heavy machinery were represented, but this is hardly to be expected at a 3 days' exhibit. Those who did come got plenty of attention to the explanations and models, and proved that it is not necessary to have a full-sized machine on the floor in order to get the merits of a device to the attention of the men who are to recommend its installation and to make its performance a success.

GROUP AT YONKERS CONVENTION

In the exhibit hall in the Armory all was in readiness on the evening of the 8th and a good crowd was busy in spite of the hard rain. At the opening session on the 9th, Mayor J. T. Lennon welcomed the delegates and Dr. Nathan Warren, as president of the Chamber of Commerce, extended the courtesies of the city and especially invited the visitors to make use of the City Club, the rooms of the Elks and other conveniences of the city. National President Walter Damon thanked the city officials for their courtesy.

After appointment of committees, the session adjourned to visit the plant of the Otis Elevator Co., where a bounteous and appetizing luncheon was served. Mr. Fitch, of the Otis Co., welcomed the gathering and Mr. Gustafson told some of the problems of elevator manufacture. The company's plants divide the work, the Yonkers plant making the electrical equipment and the traction machines, the Harrison, N. J., plant doing

most of the structural work and heavy casting, and the plants at Buffalo, N. Y., and Quincy, Ill., being largely engaged in assembling. Altogether some 450 elevators are turned out each month.

At the outbreak of the European war, the foreign plants in Russia, France, London and Germany were taken under supervision by the various governments for making munitions, and later were taken over by those governments, so that all elevator work for foreign countries is now being done in the American shops, but no munitions are being made here. The business in England and Russia is about half that before the war started.

Following this talk, Jack Armour entertained the assembled visitors for a short time, and they were then taken on a trip through the plants to see the manufacturing processes and the power equipment, and also to learn much of the ways in which elevators are controlled and operated.

On assembling at 4 p. m. the credentials committee reported 40 delegates and 3 alternates as present and they were seated. The president's report showed that the local associations were in good shape in the eastern and western parts of the state, but that the central part needed some stimulation to greater activity. Twenty out of thirty-five associations were members of the state association, and the year had shown a substantial increase in membership, which now stands at 2898. Report of the treasurer showed $271.90 spent during the year and a balance on hand of $640.39.

During the year no effort had been made for the passage of license law as that was the vote of last year's convention. Educational work in the eastern district had been largely lectures and mostly on electrical subjects as the new state law requires engineers who do work with electrical machinery to have an electrical license. In the western part of the state, a question contest was conducted, and the report of the committee gave first prize to Keystone Association No. 16 of Buffalo, second to Flower City Association No. 3 of Rochester and third to Monroe Association No. 14 of Rochester. Lectures were also given in the western district, and a few performances of a dramatic sketch, entitled "Harmony Between Engineer and Employer."

Acting on reports of committees, the convention went on record as opposed to changing the national convention from annual to biennial, and also to compulsory membership of local associations in the state association, but suggested that the smaller locals might arrange for combined representation at the state convention to reduce expense. After much discussion, it was decided that the proceedings of the convention should be printed in abbreviated form so as to give all really accomplished, but cut out unimportant matters.

Secretary Taylor, of the Life and Accident Department, urged the benefits of that branch of the work, and the need of the creation of a reserve so that the benefits can be paid at once when they become due without the delay to collect from the members. National President Damon spoke of the benefit of license law to the association and to engineers in general, and Past President Reynolds told of the success of home work with legislators in getting laws passed, the need of co-operation with other organizations, and greater interest in meetings of the subordinate associations.

It was voted to appropriate for the use of the city where the next state convention is held the sum of $50 to aid in the preliminary work, and invitation of Rochester delegates to hold the next convention there was accepted. Resolutions of thanks were passed to the Otis Elevator Co. for its hospitality and to the officials and organizations of Yonkers for courtesies extended.

Taking up election of officers, W. W. Downey, of Brooklyn, was chosen for president; George Van Vechten, of Rochester, for vice-president; William Roberts, of Yonkers, for secretary; William Downes, of New York, for treasurer; S. A. Wright, of New York, for conductor; John Elder, of New York, for doorkeeper; George Ely, of Rochester, for chaplain. John McGowan, of Brooklyn, was recommended as state deputy.

Appropriation of $100 was made for the use of the educational committee, but none for legislation, as a large part of the money in the treasury was collected for that purpose and available on order of the president. The president, vice-president and secretary were made an executive committee with power to act on the presentation of a license law bill to the next legislature.

Exhibits

For the general decorations the Stars and Stripes furnished the appropriate note, and the booths were in an attractive setting of pink, blue and white. The firms exhibiting were as follows:

Albany Lubricating Co., New York; Alberger Pump and Condenser Co., New York; American Abrasive Metals Co., New York; American Engine and Electric Co., Bound Brook, N. J.; American La France Fire Engine Co., New York; V. D. Anderson Co., Cleveland, O.; Belmont Packing and Rubber Co., Philadelphia, Pa.; Boig and Hill, New York; Bowers Rubber Works, San Francisco, Cal.; S. F. Bowser & Co., Ft. Wayne, Ind.; Combustion Appliances Co., New York; Crandall Packing Co., Palmyra, N. Y.; Dearborn Chemical Co., Chicago, Ill.; Electric Hose and Rubber Co., New York; The Fairbanks Co., New York; Gallagher and Co., New York; Garlock Packing Co., Palmyra, N. Y.; Habirshaw Electric Cable Co., New York; Homestead Valve Mfg. Co., Homestead Pa.; Huber Hand Stoker Co., New York; Jenkins Bros., New York; H. W. Johns-Manville Co., New York; Keystone Lubricating Co., Philadelphia, Pa.; The Lunkenheimer Co., Cincinnati, O.; McClave Brooks Co., Scranton, Pa.; McLeod and Henry, Troy, N. Y.; W. B. McVicker Co., New York; National Engineer, Chicago, Ill.; Otis Elevator Co., Yonkers, N. Y.; Paige & Jones Chemical Co., New York; Peerless Rubber Mfg. Co., New York; Philadelphia Grease Mfg. Co., Philadelphia, Pa.; Pierce, Butler & Pierce Mfg. Corp., New York; Wm. Powell Co., Cincinnati, O.; Power, New York; Practical Engineer, Chicago, Ill.; Pyramid Grate Bar Co., New York; Pure Water Service Co., Yonkers, N. Y.; Quaker City Rubber Co., Philadelphia, Pa.; J. A. Roebling's Sons Co., Trenton, N. J.; J. C. Ryan, Yonkers, N. Y.; C. E. Squires Co., Cleveland, O.; Geo. R. Starrs, Paterson, N. J.; United Furnace Corps, New York; F. B. Webb Mfg. Co., Boston, Mass.; Yonkers Chamber of Commerce, Yonkers, N. Y.; Yonkers Electric Light & Power Co., Yonkers, N. Y.

Engineers at the Silk City

CONVENTION OF NEW JERSEY ASSOCIATION AT PATERSON, JUNE 1 TO 4

WHILE THE EXHIBIT was on from May 29 until the close of the convention, the attendance until June 2 was largely local, the engineers from Paterson and the nearby cities coming to study modern progress and practice as illustrated by the up-to-date appliances in the booths. On the evening of the 2nd, however, as the first of the delegates arrived, the hall took on a different aspect, and was lively with cordial greetings and earnest discussions of topics technical.

Evening of the 2nd and morning of the 3rd were taken up with registration and informal discussion, and the formal opening of the convention took place at noon of the 3rd with 98 delegates present. Welcome was extended to the city and thanks returned, and directly the appointment of committees and receiving reports began.

During the afternoon, National President G. H. Damon of Springfield, Mass., arrived and addressed the meeting on the condition of the National organization and the outlook for the Minneapolis Convention in September.

After fitting reply by J. J. Callahan, the business of the meeting was resumed, and on the completion of all reports that were ready, adjournment was taken until morning.

In the evening the heavy shower made all engineers glad to seek the shelter of the exhibit hall which was a busy place until the closing, after which adjournment was taken to the Republican Club for a Smoker provided by the Exhibitors and songs and stories by "The New York Bunch." Few of those who went departed until the entertainment closed just before the midnight chimes.

Report of the Treasurer on the morning of the 4th showed that the State Association had a balance of over $230 in the treasury, and the Secretary's report showed a satisfactory gain in both associations and members for the year past. The License Law Committee gave a lengthy report of the effort to pass amendments which would correct the errors of the law now in force, make it easier to administer, place the examiners under civil service rules, and increase their salaries from $1200 to $2000 a year. This law was favored by all engineers' organizations in the State, by the manufacturers' organizations, by the Civil Service Commission and by the Labor Commission, and was passed by both House and Senate, but was vetoed by the Governor. It was put on passage over the veto and passed the House, but failed to pass the Senate as one vote only was lacking for success.

State Examiner A. L. Case reported that in 1915 there were 12,200 licenses in the State in original form, and that over 10,150 had been renewed for 1916. Also that there had been 400 new licenses taken out in 1916 by examination, and 2000 applications were on file for examination, on which the examiners are working.

Authorization was given for reprinting the Constitution and By Laws, and appropriations made, for Education, $100; for legislation, $150; for salaries and general expenses, $125; and a per capita tax of 30 cents a member was voted for the coming year to cover these expenses.

Election of officers resulted in the unanimous choice of the following: President, Thomas A. Brown of Newark; Vice-President, J. J. Reddy of Jersey City; Secretary, James S. Heath of Elizabeth; Treasurer, William Krouse of Passaic; Conductor, Allen Cunnyng of Jersey City; Door Keeper, D. V. Secor of Phillipsburg. For State Deputy of the National Association, M. P. Kelley of Paterson was recommended. Also J. J. Callahan was endorsed for National Vice-President.

After the election, the invitation of Hoboken delegates to hold the convention of 1917 in that city was accepted and the meeting proceeded to the installation of the new officers, which completed the business of the convention.

EXHIBITORS

IN THE LARGE and well lighted Auditorium was displayed a most interesting collection of devices for improving economy and reducing labor and costs. The pleasing decorations in harmonious colors and attractive design, and the wide aisles added greatly to the pleasure and comfort of visitors, and made it easy for the many interested engineers to see and the exhibitors to explain their product. Those firms having exhibits were:

Albany Lubricating Co., New York City; American Oil and Supply Co., Newark, N. J.; American Pulley Co., Philadelphia, Pa.; Boig and Hill, New York City; Bennett & Brown, Inc., Paterson, N. J.; Bowers Rubber Co., San Francisco, Cal.; Combustion Appliances Co., New York City; Crocker-Wheeler Co., Ampere, N. J.; Covell Belting Co., Philadelphia, Pa.; Dearborn Chemical Co., Chicago, Ill.; R. & J. Dick, Ltd., Passaic, N. J.; Electric Hose and Rubber Co., New York City; Fairbanks Co., New York City; Garlock Packing Co., Palmyra, N. Y.; Greene, Tweed & Co., New York City; Homestead Valve Co., Pittsburgh, Pa.: Huber Hand Stoker, Inc., New York City; Jenkins Bros., New York City; H. W. Johns-Manville Co., New York City; Keystone Lubricating Co., Philadelphia, Pa.; The Lunkenheimer Co., Cincinnati, Ohio; McNab & Harlin Mfg. Co., New York City; McClave Brooks Co., Scranton, Pa.; McLeod & Henry Co., Troy, N. Y.; Manhattan Rubber Co., New York City; Geo. A. Meyers & Co., Paterson, N. J.; H. W. Mills & Co., Paterson, N. J.; New York Belting and Packing Co., New York City; National Engineer, Chicago, Ill.; Otis Elevator Co., New York City; Peerless Rubber Mfg. Co., New York City; Wm. Powell Co., Cincinnati, Ohio; Power, New York City; Wm. L. Platt Construction Co., Paterson, N. J.; Joseph Purdy, Paterson, N. J.; Practical Engineer, Chicago, Ill.; Philadelphia Grease Mfg. Co., Philadelphia, Pa.; Wm. C. Robinson & Son Co., Baltimore, Md.; John A. Roebling's Sons Co., Trenton, N. J.; W. T. Robinson, Paterson, N. J.; Standard Pressed Steel Co., Philadelphia, Pa.; Standard Oil Co., New Jersey; Schauble Bros., Paterson, N. J.; Strong, Carlisle and Hammond Co., Cleveland, Ohio; Smooth-On Mfg. Co., Jersey City, N. J.; L. Tredennick Paint Co., Meriden, Conn.; United Oil and Supply Co., Paterson, N. J.; Van Riper Mfg. Co., Paterson, N. J.; J. A. Van Winkle Co., Paterson, N. J.; F. W. Webb Mfg. Co., Boston, Mass.; Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

Power Apparatus in Shop and Market

New Ideas In Making, Buying and Selling

Direct Steam Damper Regulator

STEAM pressure acting upon a metal diaphragm connected to lever with an adjustable fulcrum and sliding weights, is the operating principle of the Metaphram steam damper regulators for high pressure, low pressure and vapor, manufactured by the National Regulator Co., of Chicago. The diaphragm consists of a number of collapsible corrugated metal discs connected by threaded studs. Extending from the top of the diaphragm to the lever is a stem which controls the piston of the damper attached to one end of the lever.

The Metaphram high-pressure regulator, shown in Fig. 1, is a new departure in the design of high-pressure regulators. Boiler pressure is admitted direct to the inside of the diaphragm through a pipe in the

FIG. 1. METAPHRAM DAMPER REGULATOR FOR HIGH-PRESSURE STEAM

bottom of the casings and to the outside of the diaphragm through a strainer and reducing valve into the steam-tight casing around the diaphragm. If the pressure to be carried is 100 lb., the reducing valve is set to close at that pressure, and when the boiled pressure increases, the reducing valve closes and prevents any further increase of pressure on the outside of the diaphragm. The increase of pressure then goes to the inside of the diaphragm, gradually inflating it, thus forcing up the stem operating the lever and gradually closing the damper. As the steam pressure drops back toward 100 lb., the diaphragm gradually contracts and the lever returns to its normal position.

Adjustment for pressure on this regulator is made by changing the position of the fulcrum and shifting weights on lever. It is possible to mount the fulcrum on either side of the stem or turn it about to obtain a longer or shorter leverage as desired. Condensation is discharged by means of a small trap and drip pipe

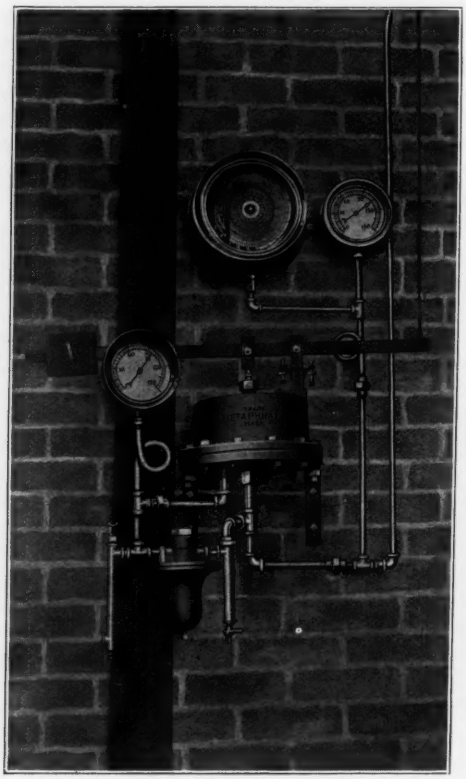


FIG. 2. HIGH-PRESSURE REGULATOR ATTACHED TO SIDE OF BOILER

running to the ash pit, thus equalizing pressure on both sides of the diaphragm. A typical installation on the side of a boiler is shown in Fig. 2.

Graduated action is a commendable feature of this regulator. In opening or closing, it does not swing from one limiting position to another, but is capable of assuming intermediate positions.

ON ACCOUNT OF the increase in factories at Waukegan, Ill., the mayor and council find it necessary to provide increased facilities for fire protection, and are discussing the installation of a new electrical driven centrifugal pump of 8,000,000 gal. capacity, to be installed in the water works' station.

McDowell Heater and Purifier

AS INDICATED in the sectional view, the McDowell heater is of multipass, water tube type, with all connections except the steam outlet made to the lower end setting chamber casting. Steam, entering at the bottom side connection, is carried through an inner cast elbow to openings through the tube head and distributed uniformly to all parts of the shell from the center. It rises in an even current to the top of the shell and is discharged from the side outlet near the top. This method of steam handling heats the water in settling chamber, utilizes the entire length of the tubes for heating surface and ensures equal expansion in all parts of the heater.

SECTIONAL VIEW OF M'DOWELL HEATER AND PURIFIER

From the inlet pocket to which the water inlet is connected, the feed water passes to the outer bank of tubes, and through them to a manifold chamber on the opposite side, formed by the tube head and the top of the settling chamber; returning in the second bank, it is passed through a second manifold chamber next to the inlet pocket to the third tube bank and so on to the fourth bank which delivers the water through an opening in the top flange of the settling chamber to the chamber below.

This chamber is extra large and is provided with a mud blowoff and a side hose connection for washing out so that it can easily be kept free of sediment. Also the tube head section is extra heavy to give strong joints and great durability.

At the top is bolted on a head which can be removed for inspection or repairs, and if the entire heater is to be cleaned only the steam outlet connection need be broken. This permits the shell to be unbolted from the tube head and removed; then the tube head can be unbolted and removed from the settling chamber, carrying the tubes with it and leaving the entire interior exposed.

Weight of the heater is carried by legs which fit into sockets in the settling chamber casting, relieving the connection bolts of all strain. It will be noted that the shell is of plate rolled up and riveted to the head castings so that there is no chance for uneven shell thickness or casting strains or defects.

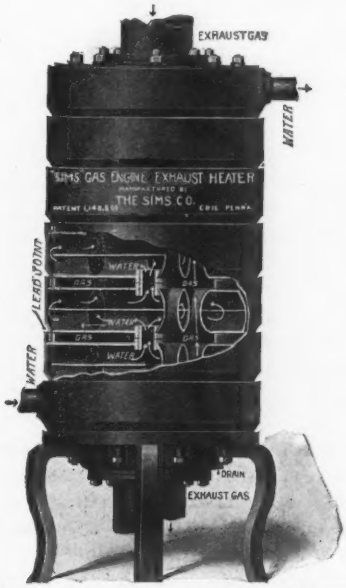
For the horizontal type, the general arrangement is the same, but the flow of water and steam is horizontal, the steam inlet is at the end of the settling chamber, outlets arranged at the top of the heater, and the shell is carried in cast saddles near each end.

The McDowell heater is the design of Geo. McDowell & Sons and is manufactured by the F. W. Horstmann Co., of Irvington, N. J.

Gas Engine Economizer

TO PROVIDE properly for a utilization of the heat value in the exhaust from an internal combustion engine, the Sims gas engine exhaust heater is manufactured and placed on the market by the Sims Co., of Erie, Pa.

This economizer is constructed entirely of cast iron, which is claimed to be the only metal to resist successfully the attack of the exhaust gases. It is formed in sections, the number and size of which depend upon the horsepower of the engine in service. Sections are properly faced, giving a metal-to-metal joint, and are supported and joined together by means of screw threaded sleeves, whereby the expansion and contraction of the sections is uniform. Each section is provided with a flange or circumferential groove forming a keystone shaped orifice, which is filled with molten metal and calked.



CROSS-SECTION OF SIMS GAS ENGINE EXHAUST HEATER

Passages for exhaust gases are provided in each section with ample area to avoid back pressure. Where 2 or more sections are used, these passages are staggered from section to section, thus bringing the hot gases in contact with the greatest possible amount of heating surface from inlet to outlet. Gas and water flow in opposite directions, counter-current, to secure the best results. Water spaces completely surround the walls of the gas passages, the connection from one section to another being through the threaded sleeves.

By an ingenious arrangement of water connections on different sections of the heater, it is possible to work out a variety of combinations, such as heating water at different temperatures, generating low-pressure steam, not to exceed 10 lb., and heating water at the same time.

Exhaust connections for this heater may either be inlet at the bottom, outlet to atmosphere at the top, or just the reverse. Where conditions make it necessary, the heater can, by special arrangement, be made for horizontal installation. It is claimed that this type of heater placed on the exhaust line will serve as an excellent muffler.

News Notes

THE SIMS CO., Erie, Pa., announces the appointment as New York Sales Manager, of C. J. Moulton, brother of the late P. A. Moulton.

BOUND BROOK OIL-LESS BEARING CO. is the new firm name of the Graphite Lubricating Co., which it succeeds. This company is located at Bound Brook, N. J., and manufactures oil-less graphite and bronze, and graphite impregnated wood bearings.

THE BORDEN CO., Warren, O., announces the appointment of W. A. Phillis, advertising manager in charge of the publicity and advertising of Beaver square end pipe cutters and easy-working die stocks. Mr. Phillis has lately been connected with the metallurgical and advertising departments of the National Tube Co.

EVERY CITY with a population of 20,000 or over will have a committee in charge of local arrangements for America's Electrical Week campaign this Fall. The National Executive Committee in charge of the big movement, of which Gerard Swope, Vice-President of the Western Electric Co., is chairman, recently announced its appointments of chairmen and local committeemen. Over 1200 representative electrical men have been appointed. The Executive Committee, through The Society for Electrical Development, made every effort to have the list representative of the different electrical interests. A central station representative was placed on the Committee in every city. This was done as central station support is necessary to get greatest possible results.

Throughout the late summer and fall, members of the Society's staff will visit different sections of the country to address the Jovian Leagues, Chambers of Commerce, and to assist the Committees in their celebration and sales plans.

U. S. CIVIL SERVICE COMMISSION announces an examination, July 18, for coal mining engineer to fill a vacancy in the Bureau of Mines, Department of the Interior, for service in the field, at a salary ranging from $2400 to $4000, and vacancies as they may occur, duties to include investigations in relation to coal mines. Graduation from a mining engineering course in a college of recognized standing, and not less than 5 yr. experience in coal mining operations, are prerequisites for consideration. Applicants must not have reached their forty-fifth birthday. Apply for Form 2118.

U. S. CIVIL SERVICE COMMISSION announces an examination, July 18, for assistant petroleum engineer, to fill a vacancy in the Bureau of Mines, Department of the Interior, for service in the field, as a salary ranging from $1800 to $2500, and vacancies as they may occur, duties being to participate in the engineering and economic work of the Bureau of Mines in relation to the refining and utilization of petroleum and its products, with particular reference to design of plants and equipment. Graduation in engineering from a college of recognized standing, and not less than 2 yr. experience in connection with the operations of petroleum properties, including experience in construction, are prerequisites for consideration. Applicants must have reached their twenty-first but not their fortieth birthday. Apply for Form 2118.

Catalog Notes

THE BAYER STEAM SOOT BLOWER for Horizontal Fire Tube Boilers, is the title of a new 16-page bulletin just published by the Bayer Steam Soot Blower Co., of St. Louis, Mo. Details of construction and operation are shown and its operating principles explained. A free copy will be sent to engineers upon request.

POWER PUMPS, vertical triplex single-acting, general service type, are described in Bulletin No. 302 received recently from the National Transit Pump and Machine Co. of Oil City, Pa. General construction of the pump is shown and data relative to sizes, capacities, and floor space required is given in tables.

EXTRA HEAVY steel gate valves for superheated steam and other power plant service, is the subject of the latest catalog of the Nelson Valve Co., Chestnut Hill, Philadelphia, Pa. This booklet contains specifications and prices, and will be sent upon request of those interested.

A LARGE BOOKLET, Bulletin No. 4, has been recently issued by the Republic Flow Meters Co., 565 Washington Boul., Chicago, describing its various types of flow-meters. It contains a steam table, and pipe dimension and velocity of flow data.

HOPPES feed water heaters, purifiers, steam separators, oil eliminators, exhaust heads and V-Notch water meters with weighing recorders are described and illustrated in Catalog No. 60 of The Hoppes Mfg. Co., Springfield, Ohio.

THE WM. POWELL CO., of Cincinnati, Ohio, will be pleased to mail upon request of those interested, a circular describing its new throttle valves, and showing construction and prices.

"INSURING THE COAL SUPPLY," Book No. 249, and Book No. 229, describing the Link-Belt traveling water-intake screens, are two bulletins recently issued by the Link-Belt Co., of Chicago.

BULLETIN NO. 120 of The Goulds Mfg. Co., Seneca Falls, N. Y., illustrates Goulds multi-stage centrifugal pumps, discussing installation and operation.

A COMPREHENSIVE treatment of tire repair is issued by the Goodyear Tire & Rubber Co., of Akron, O., to recognized tire repair men. It is called the Goodyear Manual of Tire Repairing, and is intended to discuss materials, equipment and methods of application, necessary to the complete success in making tire repairs, so as to assist in the promotion of this business.

All facts and illustrations are based on standard practice as used in the Repair Department of the Goodyear factory, and the whole scope of tire repairing is covered, from the use of gums to fill tread cuts, up to the rebuilding and vulcanization of tires.

STARRETT'S NEW CATALOG, No. 21, is now ready for distribution to mechanics, hardware men and to every man who uses tools. The new catalog consists of 336 pages of illustrations, descriptions and prices. In compiling the new book special care has been given to grouping together tools of the same classes, and to presenting the facts, in regard to the uses of the tools, as briefly and clearly as possible. The catalog is carefully indexed both by name and number, and may be obtained by application to The L. S. Starrett Co., of Athol, Mass.

BULLETIN NO. 100, entitled "Carrier Humidifying Apparatus," just published by the Carrier Engineering Corporation, 39 Cortlandt St., New York, explains such details as air supply; fixing the amount of water vapor; heating; cooling; securing various humidities from one apparatus; air distributing systems based upon ordinary galvanized iron ducts; interior risers, hollow pilasters, central vertical flues; automatic dew point control; proportioning fresh and return air; etc. Mention Practical Engineer and a copy will be mailed free.

NEW CATALOGS have been received from Wm. B. Scaife & Sons Co., Pittsburgh, as follows: Copper Brazed High-Pressure Tanks, for air, gas and liquids; Pneumatic Water Supply Tanks and Hot Water Storage Tanks; Gasoline Storage Outfits and Garage Air Tanks; Steel Tanks for Motor Boats; Galvanized Range Boilers.

DEMAND FOR INFORMATION on foreign trade matters has led the Bureau of Foreign and Domestic Commerce, Department of Commerce, to publish a book of practical suggestions, not concerned with the sale of any particular lines of goods in foreign markets, but treating of the problems which sooner or later confront exporters in every line. The bulletin contains a wealth of practical information under the following headings: Export Policies, Representatives and Agencies, Finances and Credit, Quotations, Postal Services, Correspondence and Translations, Cooperation with Consuls, Packing, Advertising, and General Trade Extension. Contributions are included from consuls, commercial attaches, traveling special agents, from special agents in charge of district offices of the Bureau of Foreign and Domestic Commerce, and from Dr. E. E. Pratt, Chief of the Bureau.

The new bulletin, entitled Export Trade Suggestions, which is No. 35 of the Miscellaneous Series and contains 141 pages, can be purchased at 15 cents a copy from the Superintendent of Documents, Washington, D. C.

RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y., has issued a bulletin under the date of December, 1915, which gives general information regarding its courses in engineering and science.

THE BORDEN CO. of Warren, O., has just issued a new booklet describing Beaver Easy Working Die Stocks and Square End Pipe Cutters. The booklet goes to some length in presenting the merits of these useful tools, describing the various types and the principles upon which they operate.

TESTS TO DETERMINE the action of concrete and reinforcing steel in flood slabs of the slab type of building construction have been made by the Engineering Experiment Station of the University of Illinois on the Shredded Wheat Factory at Niagara Falls, N. Y., the Soo Line Freight Terminal at Chicago, the Schulze Baking Co. Building at Chicago, the Curtis-Leger Co. Building at Chicago, and a special test structure at Worcester, Mass.

The methods employed and the results are given in Bulletin No. 84 of the Engineering Experiment Station by Professor A. N. Talbot, and W. A. Slater. The data obtained have been analyzed with the result that many new facts of interest and importance to designers and builders of concrete flat slabs structure have been developed.

Copies of Bulletin No. 84 may be obtained from W. F. M. Goss, Director, Engineering Experiment Station, Urbana, Ill.

THE NATIONAL Highways Association has issued a series of interesting and attractive maps of the proposed "Good Roads Everywhere," which it is the purpose of this society to advocate. Roads in different sections are being pushed by various allied associations, the idea of the Association being to secure a great system of national highways for the benefit of the country at large as well as for use in case of defense.

A 4-fold system is advocated; first, a network of national highways to be built and maintained by the national government. This will relieve the states of the upkeep of these main arteries for traffic, and will permit them, without additional expenditure, to maintain a related system of state highways as feeders to the main arteries. In turn, the different counties in the state will be relieved of the expense of such roads as are included in the national system and in the state system, leaving the expenditure now made by counties to be applied to other county roads, which will be auxiliary to the national and state systems. By the same principle, these county roads will relieve townships of the expense on much of their present mileage, which can, in turn, be devoted to the maintenance of the balance of the township roads, which will serve as branch lines to lead to the county, state and national systems. In this way, practically the entire country can be provided with a system of good roads, which will be maintained without greater expense to state, county and township than is now involved in the effort to maintain the present system, which in many instances is entirely unsatisfactory.

A photographic contest is in progress, with cash prizes amounting to $2600 for 166 selected photographs of good or bad road conditions. Photographs for this

contest should be sent to Good Roads Everywhere Photograph Contest, National Highways Association, Washington, D. C. Any number may be sent by any person, whether a member of the Association or not, the contest closing Nov. 7, 1916. Further information in regard to membership and activity of the Association can be secured from the headquarters of the Association in Washington.

SWITCHBOARD METERS for measuring pressure, current and energy, as manufactured by the Westinghouse Electric & Mfg. Co., are described in catalog section DS919, issued by this company. The particular advantages of this type of motor are thoroughly explained and illustrations are given of the different types of meters including illuminated dial type.

Trade Notes

THE VULCAN SOOT CLEANER CO., of Du Bois, Pa., state that Vulcan soot cleaners are to be installed on 50 boilers of the B. & W. type, totaling 30,000 hp. rated capacity, at the Marion plant of the Public Service Electric Co. of New Jersey. The same company has recently equipped its 1375-hp. boilers for the new Essex plant with Vulcan soot cleaners. This is the fifth order received from the public Service Electric Co.

Other large orders have been received recently by the Vulcan Soot Cleaner Co., from Calumet Hecla Mining Co.; Youngstown Sheet & Tube Co.; Duquesne Light Co., Pittsburgh, Pa.; Merrimac Mfg. Co., Lowell, Mass.; Consolidated Gas & Electric Co., Baltimore, Md.; North American Chemical Co.; Buffalo General Electric Co.; Chicago and Northwestern R. R. Co.

REMINGTON Arms & Ammunition Co. purchased 1017 Nicholson compression shaft couplings—for 2 7/16-in. shafting—from W. H. Nicholson & Co., Wilkes-Barre, Pa. Four jaws, flat along one edge and tapered up from both ends to the center along the other edge, lay on the shaft at intervals of 90 deg. Two heavy cast-iron flanges, machined to fit the tapered jaws, slide over the ends, and are then bolted together by 4 bolts. Naturally, the tighter the nuts are pulled up, the greater the pressure on the jaws, and the tighter the grip on the shaft. These couplings are installed in a new plant at Ilion, N. Y.

DURING THE PAST MONTH, the Sims Co., of Erie, Pa., has received through its New Orleans representatives, Haubtman-Loeb Co., orders for 7 sugar juice heaters. These heaters vary from 800 to 1500 tons capacity, and are for export to Cuba. The Sims Co. has also received an order from the Aluminum Co. of America for 2 special liquid heaters for its East St. Louis plant, making a total of 12 Sims heaters now in service at that plant.

THE CHICAGO NORTHWESTERN RAILWAY has purchased from the Westinghouse Electric & Mfg. Co., of East Pittsburgh, Pa., 2 1500-kw., turbo-generator units, complete with condensers 1 500-kw. turbo-generator unit with condensers, and 1 50-kw. turbo generator. This equipment is to be installed in the Calumet Terminal of Chicago, Northwestern Railway at Chicago, Ill., and is to be used in operating one of the largest grain elevators in the world.

PRACTICAL ENGINEER

Trade-mark, Reg. U. S. Pat. Off.

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Front cover $150.00 per issue.
Other specified positions, regular rate plus 10 to 50 per cent.
Stippled plates used, but no heavy, black and white plates.

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Per line, 30 cents each insertion.
Advertisements in this section are inserted under regular headings.
No display type allowed, but the first three words may be set in capital letters.
About nine words make a line. Minimum space sold, two lines.
Under classification "Position Wanted," advertisements not exceeding four lines will be inserted once for subscribers free of charge.
All copy should be received at Chicago office 18 days before date of publication.

Circulation of this issue, 22,500.

Technical Publishing Co.

537 S. Dearborn Street

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Position Wanted

POSITION WANTED—As master mechanic or assistant; 21 years' experience. Had charge of erecting, repairing heavy duty engines, machinery and mixed blow turbines. Expert on lubricants. Address Practical Engineer, Box 435, Chicago, Ill. 7-1-1

POSITION WANTED—Chief engineer in a small plant or operator in a large; 12 years' practical experience with steam, electric, refrigerating, pumping and condensing equipment. Technical education. First-class license and references; married, age 31, employed. Practical Engineer, Box 434, Chicago, Ill. 7-1-1

POSITION WANTED—License chief engineer wants change; 12 years' experience in manufacturing and central stations, steam electrical, refrigeration and producer gas, high speed and Corliss engines, condensers, etc. Age 32, American and married. Address Box 437, Practical Engineer, Chicago, Ill. 7-1-1

POSITION WANTED—By chief engineer, 35, married. Use no liquor; 15 years' experience, electrical and refrigeration. Wants position where ability and push will count. Can get results if given opportunity. Practical Engineer, Box 436, Chicago, Ill. 6-15-2

POSITION WANTED—Young man wants position as helper, extra engineer or fireman. Two years' practical experience. I. C. S. student. Write Rasmus Stenner, 300 Fremont St., Portland, Ore. 7-1-1

POSITION WANTED—Young man wants position as helper and extra engineer in steam plant for a start. Other particulars answered by letters. Write to W. D. Bellesfield, Rock Valley, Iowa. 5-15-3

POSITION WANTED—By young man as oiler or fireman in a modern plant. I. C. S. graduate. Address Frank Knapp, 323 S. 5th St., St. Joseph, Mo. 7-1-1

Help Wanted

WANTED—Resident subscription agents in the following cities: Atlanta, Ga.; Cincinnati and Columbus, Ohio; Kansas City, Mo.; Los Angeles, Cal.; Louisville, Ky.; Newark, N. J.; New Orleans, La.; Portland, Ore.; St. Louis, Mo.; San Francisco, Cal.; Washington, D. C. This is an excellent chance for a hustler who is familiar with power plant conditions, to turn his spare time into dollars. To such a one we offer a Real Opportunity. Write Subscription Department, Practical Engineer, 537 S. Dearborn St., Chicago. tf.

Wanted

MANUFACTURERS—ATTENTION—Have you an opening for a young man of good appearance and address, married, who is now, and has been for more than five years, Western sales manager for one of the largest and best known manufacturers of injectors and steam specialties? Enjoy wide acquaintance among jobbers of engineers, mill and plumbing supplies. Could market meritorious specialty. Unquestionable references as to ability, reliability, etc. Address Practical Engineer, Box 442, Chicago, Ill. 7-1-1

WANTED—Agents handling engine and boiler-room specialties in every section for side line paying large commissions. Give experience, line carried and territory covered. Address Practical Engineer, Box 381, Chicago, Ill. tf.

WANTED—Agents to handle Chemicals for Boiler Rooms, Laundries and the Automobile Trade. Strictly commission basis. State age and experience. Address Practical Engineer, Box 440, Chicago, Ill. 6-1-6

WANTED—Agents on commission to sell our Shaking Grates. We will install grates on trial or put it on test at our expense with any grate made. Address Armstrong Mfg. Company, Springfield, Ohio. tf.

WANTED—High Pressure Water Tube Boiler, about 30 hp., marine type. Describe. Address P. Kalnin, Groton, Mass. 7-1-1

For Sale

FOR SALE—Steam Engine Indicator. Two cylinders and piston. Six springs. Reducing motion. Two cocks and carrying case. This instrument is good as new and will be sold subject to approval. Address Indicator, care Practical Engineer, Chicago, Ill. 6-15-2

FOR SALE—Second-Hand Machinery. One Hamilton-Corliss engine, 22x48, A1 condition. One 50-inch Fay-Egan band resaw and grinder. One 10-inch Fay-Egan 4-sided moulder. One 6-inch H. B. Smith 4-sided moulder. One Fay-Egan sash tennoner with double cope knives and cut-off saw. One 30-inch heavy cabinet planer (Whitney), with sectional feed rolls and sectional chip breaker. All above in first-class condition. The Vinton Company, Detroit, Mich. 6-15-2

FOR SALE—Boilers (watertube) (insurance certificate 150 lb. pressure): Ten 250-hp. Babcock & Wilcox, $11,250. One 425-hp. H. P. Babcock & Wilcox, $1900. Two 350-hp. Heine, $3000. Three 300-hp. Babcock & Wilcox, $4000. One 200-hp. Heine, $800. Power Machinery Exchange, Inc., 14 Morris St., Jersey City, N. J. 7-1-1

FOR SALE—14x36 E. P. Allis Corliss engine, 100 hp., 100 r.p.m., cylinder re-bored, thoroughly overhauled one year ago; good as new. Dubuque Brewing & Malting Co., Dubuque, Ia. tf.

Patents and Patent Attorneys

PATENTS THAT PROTECT AND PAY—Advice and books free. High references. Best results. Promptness assured. Send sketch or model for search. WATSON E. COLEMAN, Patent Lawyer, 624 F St., N. W., Washington, D. C. tf.

PATENTS—C. L. Parker, Attorney-at-Law and Solicitor of Patents. Patents secured promptly and with special regard to the legal protection of the invention. Handbook for inventors sent upon request. Washington, D. C. tf.

PATENTS—H. W. T. Jenner, Patent Attorney and Mechanical Expert, 606 F St., Washington, D. C. Established 1883. I make a free examination and report if a patent can be had, and the exact costs. Send for full information. tf.

A. P. CONNOR, Consulting Electrical and Mechanical Engineer, Attorney-at-Law and Solicitor of Patents and Trade-Marks. Results guaranted. 121 Carroll St., S. E., Washington, D. C. tf.-x.

PATENTS—Send sketch for free search and reports. Books on patents and book of reference letters sent free. John S. Duffie & Co., 612 F St., Washington, D. C. tf.

PATENTABLE IDEAS WANTED—Send for three free books. R. B. Owen, 28 Owen Bldg., Washington, D. C. tf.

Technical Books

ENGINEERS AND FIREMEN—Send 10c in stamps for a 40-page pamphlet containing a list of questions asked by an examining board of engineers. Stromberg Publishing Co., 2238-A Pope Ave., St. Louis, Mo. E.O.I.-tf.

Miscellaneous

FREE ENGINEER BOOKS and power plant tools and specialties, for securing new subscribers to Practical Engineer. A dandy chance for the engineer with a little spare time, to get some fine premiums. Send for free descriptive circular and terms. Address Practical Engineer, Subscription Department, Chicago, Ill.

ENGINEERS, DO YOU WANT to utilize your exhaust steam for heating or drying purposes without back pressure on your engine? If so, address Monash Engineering Co., 1413 W. Jackson Blvd., Chicago, Ill.

THE CITY OF WAHOO will receive bids up till 2 o'clock, July 26, for the purchase of the following machinery: One 225-hp., either simple or tandem compound Corliss engine, or one 225-hp. Uniflow engine, same to be direct connected to a 150-kv.a., 2300-v. generator, exciter, switchboards, 25-hp. motor and a triplex pump. Specifications are on file in the office of the Water and Light Commissioner, City of Wahoo, Neb. 7-1-2

Sparks From The Advertising Pages

Odds and Ends

Many an engineer enters a plant where the equipment is the odds and ends of a variety of things mechanical. Especially is this true where the plant is small and is the property of a new concern just in the creeping stage, with great possibilities but not always immediate capital. Used equipment is often bought and installed, because of a low first cost.

Such a condition stares the engineer full in the face, but does not often "feaze" him because he is by temperament and of necessity resourceful in his particular line of endeavor. He racks his brains to overcome the handicap of inefficient machinery. His is an endless fix-this and fix-that undertaking.

With a wad of home-made packing he can silence a joint that is sputtering and spitting like a fool tom-cat. Many times he has employed a brace and bit and a reamer to reface old pump valve seats. He must nurse along this machine and humor that one. And he does all this with little or no concern because his school of hard knocks has taught him that trouble in a power plant is a necessary evil. So closely is he related to Necessity, the grand old mother of invention, that he has rigged up many a device to "tide him over" until "the company buys some new stuff."

But is this condition conducive to the best interest of all concerned? It is well that an engineer can adapt himself to the many conditions in which he finds himself, but he must not overlook the fact that where it is in his power to remedy conditions he must do so. One can grow so accustomed to environment as to become part and parcel of it without discovering that it has stifled ambition and arrested progress.

There are many devices for the power plant that practically pay for themselves in a few months, so economical are they. For instance instead of using the inefficient brace, bit and reamer in refacing worn valves, the engineer can use any of the mechanical devices that true up the seats accurately and do the job quicker. The cost is saved in a surprisingly short time. This is only one instance; opportunities are constantly confronting the engineer where a little suggestion will be welcomed by the management.

The wise thing to do is to keep constantly posted on the things that are essential to the progress and profits of your plant. The best way to do it is through the advertising pages of Practical Engineer.